(08/27/2001)

U. S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460
OFFICE OF PREVENTION, PESTICIDE AND TOXIC SUBSTANCES

PC Code No. 035505
DP Barcode: D275045

MEMORANDUM

SUBJECT: Environmental Risk Assessment for the Reregistration of Diuron

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Attached is the Environmental Fate and Effects Division's (EFED) environmental risk assessment for the diuron RED (Case # 818790). The attached documents contain drop-in chapters for the environmental fate and transport assessment, the ecological risk assessment, integrated risk characterization, and drinking water assessment.

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Summary of Drinking Water and Ecological Risk

Drinking Water

- Diuron is persistent, mobile, and has been found in both surface and ground water. Parent diuron is frequently detected in surface water and ground water with concentration ranging from 2.7-2849 ppb in surface water and 0.34-5.37 ppb in groundwater. However, available monitoring data may not fully reflect diuron's temporal and spacial variability. Therefore, frequent detection of diuron residues and occasionally high residues in the monitoring studies along with incident reports confirm EFED concerns for aquatic plants and animals. If any intakes are located downstream from diuron use areas, these intakes will likely receive get some exposure from drinking water. Also, if any wells draw ground water in diuron use areas, there is some possibility of exposure.

- The metabolite, 3,4-DCA, is of concern to human health and has been found in the environment in surface water. It is formed from applied diuron, linuron, and propanil. Because of its persistence and degradation pathway, diuron produces less 3,4-DCA than propanil and possibly linuron. Based on limited environmental fate data, 3,4-DCA is formed at <1 % of applied diuron. However, measurements of 3,4-DCA from surface water monitoring studies in five southern states reached up to 26 ppb in the Yazoo River Basin where both propanil and diuron are used extensively. However, there are no nearby surface water intakes where the highest concentrations were observed. Although it is commonly seen in surface water in areas with high diuron and propanil usage, EFED has received no guideline studies on ecological effects or environmental fate and transport of 3,4-DCA. EFED believes that at minimum laboratory studies are needed to fully understand both the fate and transport and the impact on fish and wildlife from 3,4-DCA.

Terrestrial Organisms

- Potential acute risk to birds based on maximum labeled rates from high application sites (right of ways, grapes, and citrus) using 6.4-12 lbs ai/A.

- Potential risk of reproductive impairment to birds is assumed because of persistence but is uncertain due to need for additional data for confirmation.

- Potential acute risk to small mammals feeding in short grass treated with diuron at a rate of 12 lbs ai/A.

- Potential chronic risk to mammals at all application rates

- Potential risk to terrestrial plants at all application rates

Aquatic Organisms

- Potential acute risk to freshwater fish at a one-time rate of 12 lbs ai/A for right of way use
- Potential acute risk to freshwater invertebrates at one-time rates of 3.2 lbs ai/A and above
- Potential chronic risk to freshwater fish and invertebrates at one-time rates of 9.6 lbs and above
- Potential chronic risk to estuarine invertebrates from a one-time rate of 12 lbs ai/A
- High potential for risk to aquatic plants from all application rates.

Outstanding Data Requirement

Requirements for Additional Data

Required Study	Guideline Number
Environmental Fate	
Upgrade of leaching-adsorption-desorption (material balances for definitive study needed, 44490501)	163-1
Hydrolysis of 3,4-DCA	161-1
Aerobic Soil Metabolism of 3,4-DCA	162-1
Aerobic Aquatic Metabolism of 3,4-DCA	162-4
Leaching-Adsorption-Desorption of 3,4-DCA	163-1
Ecological Effects	
Avian reproduction study (based on persistence of diuron)	71-4
Freshwater aquatic invertebrate early life-cycle toxicity study (previous study failed to establish NOAEC	72-4(b)
Estuarine/marine fish early life stage toxicity study (previous study failed to establish NOAEC)	72-4(a)
Nontarget aquatic plant toxicity study [a]	123-2
Avian dietary LC_{50} - 3,4-DCA	71-2 (a)
Freshwater fish LC_{50} - 3,4-DCA	72-1 (b)

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Freshwater invertebrate acute LC_{50} - 3,4-DCA	72-2
Nontarget terrestrial plant seedling emergency toxicity [b] (Tier II) -3,4-DCA	123-1
Nontarget terrestrial plant vegetative vigor toxicity (Tier II) - 3,4-DCA [b]	123-1
Nontarget aquatic plant toxicity - 3,4-DCA [c]	123-2

a This study is required for herbicides. The study should include four species of aquatic plants (*Kirchneria subcapitata, Anabaena flosaquae*, a freshwater diatom. and duckweed , *Lemna gibba*). b. Tomato and onion c . *Skeletonema costatum* and *lema gibbs*

A complete listing of submitted data and data requirements for environmental fate and transport, and modeling input and output data, and the ecological effects characterization may be found in Appendices 1, 2, and 3 of the EFED RED Chapter, respectively.

Recommended Label Language

The following precautionary statements should be included on both manufacturing and end use product labels

Environmental Hazards

i. Non-aquatic use

- This pesticide is toxic to fish and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment wash waters or rinsate."

ii. Aquatic use

- Treatment of aquatic weeds can result in oxygen loss from decomposition of dead weeds. This loss can cause fish suffocation. Therefore, to minimize this hazard , treat 1/3 to ½ of the water area in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Consult with the State agency in charge of fish and game before applying to public waters to determine if a permit is needed.

- Observe all cautions and limitations on labeling of all products used in mixtures.

Surface Water Label Advisory

This product may contaminate water through drift of spray in wind. This product has a potential for runoff according to the pesticides "mean" soil partition coefficient (K_d) for several months or more after application. Poorly draining soils and soils with shallow watertables are more prone to produce runoff that contains this product. A level, well maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential for contamination of water from rainfall-runoff. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours. Sound erosion control practices will reduce this product's contribution to surface water contamination.

Ground Water Advisory

Diuron is known to leach through soil and into ground water under certain conditions as a result of label use. Use of this product in areas where soils are permeable, particularly where the water table is shallow, may result in ground water contamination.

Environmental Fate and Ecological Risk Assessment for the Re-Registration of Diuron N'(3,4-dichlorophenyl)-N'N-dimethylurea

Prepared by:

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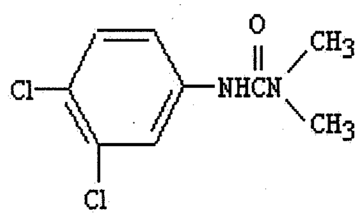

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ENVIRONMENTAL RISK CONCLUSIONS

Diuron has a wide range of application rates (1.6 to 12 lbs ai/A), but the higher application rates are used for row or spot treatments of nonagricultural sites, grape vineyards and orchards. It is stable to hydrolysis and photolysis and very persistent on soil. It is moderately mobile and has been found in ground water and surface water. The major metabolites are sequentially demethylated diuron compounds, DCPMU and DCPU, which have no herbicidal effects. The ecological effects of the minor metabolite 3,4-DCA are unknown.

Based on the likelihood of environmental exposure and high RQ values, diuron poses potential risk to terrestrial and aquatic animals and nontarget terrestrial and aquatic plants. For animals, the acute RQ values based on the maximum exposures are as follows: mammals (1.19-9.22), avian (<1.16), and aquatic animals (1.35-9.00). For plants, the acute RQ values ranged from 1.25-76.5, and the endangered species RQ values ranged from 6.5-306. No avian chronic data are available, but exposure and risk are expected to be high because of diuron's persistence in environment.

Finally, environmental monitoring studies have routinely confirmed diuron residues at occasional high concentrations in both surface and ground water. OPP's Ecological Incident Information System (EIIS) summary report confirmed 29 cases of incidents involving nontarget organism that occurred mostly in the 1990's. Of the 29 incidents, one included birds, 16 involved fish, and 12 involved plants. EFED believes that the reported incidents are only a subset of the total number of incidents that are likely occurring because of uncertainty due to spacial and temporal variation of monitoring studies and voluntary incident reporting.

INTRODUCTION

Diuron (PC Code 035505) is a pre-emergence contact herbicide belonging to the substituted urea herbicides. Diuron is the common name for 3-(3,4-dichloro phenyl)-1,1-dimethyl urea. It is formulated as a wettable powder and as a flowable liquid suspension.

Mode of action

Diuron is a strong inhibitor of the Hill Reaction in plant photosynthesis. This inhibition prevents the formation of high energy compounds, i.e. ATP and NADPH, which are required for carbon dioxide fixation and numerous other biochemical reactions.

Use characterization

Diuron is registered on both agricultural and non-agricultural use sites, and is used in combination with other herbicides to control a wide variety of weeds. Diuron is used primarily as a pre-emergent herbicide to control annual grasses and broadleaf weeds in crops such as alfalfa, artichoke, asparagus, bananas, barley, Bermuda grass pastures, blueberries, cranberries, gooseberries, corn, cotton, grapes, perennial grass-seed crops, papayas, peppermint, pineapple, plantains, sorghum. sugarcane, small grains, and several fruit- and nut-tree crops as well as certain ornamentals. For these selective uses, the application rates are relatively low, usually 1-4 lbs/A. Diuron is usually applied in conjunction with surfactants.

Application rates and Methods

Table 1 below summarizes the various usages, application rates, and application methods for diuron. In addition to the maximum labeled rates, Table 1 includes the typical application rates used by 80 % of growers, according to the registrant's survey. The higher application rates (6.4 - 12 lbs. ai/A) are for non-agricultural sites and some crops such as grapes and citrus. The typical application rates are usually 50-80 % lower than labeled rates.

Table 1. List of maximum labeled application rates and methods for diuron

End-uses	Appl. Methods *	Max. Label Rates (lbs ai)	Typical Rates(lbs ai)	Seasonal Max. Rate
Non-Agricultural				
Railroad	A/G	12	6	12
Roadside, utilities, irrigation, drainage ditch	G	12	6	12
Non-Agricultural				
grape	G	9 .6	2.0	9.6
citrus	G	6 .4	3.2	9.6
Alfalfa	A/G	3. 2	2.4	3.2
Fruits (Peach, Apple, Pear)	G	3.2 - 4.0	3.2	4.0
Sugarcane	A/G	3. 2	2.4	9.6
Grass seeds	A/G	3.2	1.5	3.2
Cotton	A/G	1.6	0.8	2.2

A = Aerial, G = Ground

Chemical and Physical properties

Common Name: Diuron

Trade Name(s): Karmex, Krovar, Direx, Dailon, Herbixol, Tigrex, Unidron, Vonduron, Crisuron.

Chemical Name: N'-(3,4-Dichlorophenyl)-N,N-dimethylurea.

Chemical Abstract Registry No.: 330-54-1

Type of Product: Herbicide

ENVIRONMENTAL RISK CHARACTERIZATION

Summary of Risk Assessment

Note: Conclusions of ecological risk are based on a screening level assessment. In the past, these risks would have been characterized as "high" acute or chronic risk. However, recognizing the uncertainty in the ability of a screening level assessment to quantify the level or significant of risk, the EFED is changing the wording of the conclusions when exceeding the LOC is based solely on screening level risk assessment. This change does not reflect a change in the risk assessment process, or alter the criteria of exceeding the LOC's. Also, it does not change the other presumptions of risk, including those related to restricted use and endangered species.

The major concerns for diuron are

- risk to plants
- -acute and chronic risk to aquatic organisms and mammals
- suspected chronic risk to birds due to high application rates and persistence

The major ecological concern from the use of diuron is the impact on non-target plants, both terrestrial and aquatic. All RQ s exceeded the level of concern for both terrestrial and aquatic non-target plants. The terrestrial plant RQ values ranged from 1.25-77 for acute effects and 5-306 for endangered plants. The aquatic plant RQ values ranged from 9.6 to 171.7, indicating acute risk to aquatic plants.

Another environmental risk concern is acute and chronic risk to terrestrial and aquatic non-target organisms. These risks are expected to increase with increasing application rate. The sites with the higher broadcast application rates include non-agricultural sites (12 lbs. ai/A), grape vineyards (9.6 lbs. ai/A.), and orchards (6.4 lbs. ai/A). Non-agricultural sites include rights-of-way (e.g. sides of roads and railroads), utilities, and areas around industrial buildings. However, diuron is applied as a spot treatment for these uses. Spot treatment refers to application to part of an area, and as a result, the probability of ecological exposure will increase with the percent of the area treated. For vineyards and orchards, row treatments are used where only part of the field is treated. Approximately 33 % of the area in a vineyard may be treated, while only 45 % of a citrus orchard may be treated. Therefore, application rates for these crops are 2.9-3.2 lbs ai/A instead of the 6.4-9.6 lbs ai/A broadcast rates. Even with these reduced application rates in vineyards and citrus, our level of concern is still exceeded for endangered species of non-target terrestrial organisms (birds and mammals). Due to persistence, organisms may be exposed to toxic residuals for extended periods of time.

In addition, EFED has concerns for acute and chronic risk to birds. At an application rate of 4 lbs ai/A, there are potential acute risks on birds. EFED assumes chronic risk to birds because diuron is persistent, and a rat study showed chronic effects to mammals (reduced pup body weight). However, EFED cannot confirm chronic risk to birds because we have received no studies on the effects of diuron on avian reproduction.

Reported Diuron Incidents

There are 29 ecological incident reports for nontarget organisms, reported mainly in 1990's. Of the 29 incidents, one involved birds, 16 involved fish, and 12 involved plants, of which one case included tissue analysis for both fish and plants. EFED believes that the reported incidents are only a subset of the total number of incidents that are likely occurring because of uncertainty due to spacial and temporal variation of monitoring studies and voluntary incident reporting.

Metabolite 3,4-DCA

The metabolite, 3,4-DCA, is of concern to human health. It is formed from applied diuron, linuron, and propanil. Because of its persistence and degradation pathway, diuron produces less 3,4-DCA than propanil and possibly linuron. Although it is commonly seen in surface water in areas with high diuron and propanil usage, EFED has received no guideline studies on ecological effects or environmental fate and transport of 3,4-DCA,. EFED believes that at least laboratory studies are needed to fully understand both the fate and transport and the impact on fish and wildlife from 3,4-DCA.

Exposure Issues

Typical Application Rates and Effect on Ecological Risk

The typical application rates for diuron are lower than the maximum labeled rates. However, even the typical rates of diuron exceed our level of concern for plants. Based on a survey by the registrant, the typical rates applied by 80 % of users are 20-50% of label rates. In addition to the registrant survey, average weighted application rates are about half the maximum labeled rates based on BEAD's QUA. The QUA also claims that rates for agricultural sites are generally less than 2 pounds ai/A, and not exceeding 3 pounds ai/A/year. It also claims that rates for non-agricultural sites are generally less than 6 pounds ai/A/year. EFED recommends that these typical rates be put on the label as the maximum rates so that ecological exposure and risk to terrestrial and aquatic animals may be reduced.

ENVIRONMENTAL FATE AND TRANSPORT ASSESSMENT

Summary

Diuron is persistent. It is stable to hydrolysis at pH's 5, 7, and 9. The calculated half-lives in aqueous and soil photolysis studies were 43 and 173 days, respectively. The half-lives in aerobic and anaerobic soil metabolism studies were 372 and 1000 days, respectively. However, in viable laboratory aquatic systems, degradation appeared to be accelerated with half-lives of 33 and 5 days in aerobic and anaerobic systems, respectively. The predominant degradate formed in both the soil photolysis and aerobic soil metabolism studies was DCPMU. The only significant (>10 % of applied) degradate in the aerobic and anaerobic aquatic metabolism studies was mCPDMU. Diuron dissipated in bare ground plots with half-lives ranging from 73 to 133 days, and the major degradate (mCPDMU) dissipated in the same plots with half-lives range from 217 to 1733 days. Diuron and mCPDMU residues were detected mainly at the upper 15-30 cm depths at all sites and sporadically detected below this depth.

Diuron has the potential to leach to ground and to contaminate surface waters. An upgradable adsorption/desorption/leaching study (MRID #44490501) showed that diuron has low-medium K_{oc} (468-1666). In addition, diuron has low water solubility (42 ppm).

The degradate 3,4-DCA is a common degradate for diuron, linuron, and propanil. EFED does not have sufficient fate and transport data on 3,4-DCA. This compound from applied propanil dissipated in an aerobic soil metabolism study with a half-life of 30 days (MRID# 41537801), and in paddy water with half-lives ranging from 2-3 days (MRID# 42200401, 42200501). Even though these studies suggest that 3,4-DCA will not persist in soil or water, 3,4-DCA has been detected often in surface water. Thus, more data is needed to understand the fate of this degradate in soil and water.

Tetrachloroazobenzene (TCAB), also a degradate of concern for human health, was identified as one of the minor degradates of diuron in a soil photolysis study (MRID No. 41719302) with a maximum concentration of 0.038 ppm.

Water Resources Assessment

Surface Water

EFED has limited monitoring data on the concentrations of diuron in surface water at the present time. Therefore, the ecological effects and drinking water assessments will be bounded, using monitoring as a lower bound of exposure and modeling as an upper bound of exposure. based on environmental modeling and exposure summary of monitoring data will be provided to place the modeling in proper context.

3,4-DCA is a common degradate for diuron, linuron, and propanil. 3,4-DCA from propanil dissipated in aerobic metabolism study with a half-life of 30 days (MRID# 41537801), and in paddy water with half-lives range from 2-3 days (MRID# 42200401, 42200501). Thus, the limited available fate characteristics suggest that 3,4-DCA is not expected to persist in soil or water. More fate studies is needed to fully understand the fate of this degradate in the environment.

A study on the occurrence of cotton herbicides and insecticides in Playa lakes of the high plains of western Texas concluded that diuron was the major pesticide detected in water samples collected from 32 lakes with a mean concentration of 2.7 ppb (Thurman et al, 2001). Diuron metabolites (DCPMU, DCPU, and 3,4-DCA) were found in 71% of the samples analyzed. The mean concentrations were 0.45 ppb for DCPMU, 0.31 ppb for 3,4-DCA, and 0.2 ppb for DCPU. In this study, water samples were taken within two days after diuron application to cotton in the region. Diuron usage on cotton in this part of the state reached an average of $\geq$1379 lb ai/mile^2/yr. Even though the use of diuron on cotton in this part of the state is representative of actual use area, the frequency of surface water sampling and the length of sampling period were insufficient to satisfy the temporal and spatial requirements for regulatory purposes. This study has limited use in a national assessment because we do not expect western Texas to be one of the most vulnerable areas for runoff. However, because the samples were taken within two days after application, the results may represent a lower bound of possible peak concentrations that could occur in drinking water in that area.

The US Geological Survey (USGS) National Water Quality Assessment Program (NAWQA) collected 1420 surface water samples from 62 agricultural stream sites during the period from 1992-1998 (USGS, 1998). One to two samples were collected each month during periods when pesticide transport in the streams was expected to be low. At most sites, the sampling frequency was increased to 1 to 3 samples per week during periods when elevated levels of pesticides were expected in the streams. Diuron was detected in 7.32% of the samples (detection limit = 0.05 ppb) with a maximum concentration of 13 ppb (estimated concentration).

Even though, the surface water monitoring data collected by NAWQA are from sites considered typical use areas, the frequency of sampling and the length of sampling period were not sufficient to represent the temporal and spatial requirements for regulatory purposes.

An edge of plot-right of way study was conducted in the state of California from September 1991-November 1991. Sampling of runoff events showed that diuron was detected in 100% of the samples with a maximum detection of 2849 ppb (Powell et al., 1996).

Monitoring has also shown high concentrations of 3,4-DCA in smaller streams such as bayous, creeks, and rivers. In MS, MO, TN, AR, and North LA, Harris (2001) reported that 3,4-DCA did not exceed 26 ppb in surface water (96.2% detection rate, 333 detections, 13 non-detections). The overall concentrations ranged from below the detection limit of 0.05 ppb to 26 ppb, with the majority of the sample detections being <1 ppb. EFED notes that 3,4-DCA was detected in these regions year-round; higher concentrations were generally associated with the application time of pesticides. DCA detections in MS, MO, TN, AR, and North LA are likely to be a result of both diuron and propanil applications for cotton and rice production, respectively. However in

South Louisiana, there were only three samples analyzed for 3,4-DCA in the suburban area of E. Baton Rouge Parish. The concentrations ranged from 0.01-0.06 ppb in these three samples along with diuron (Walters, 2001). Therefore, the presence of DCA in these samples is most likely due to roadside use of diuron because cotton and rice are not grown in E. Baton Rouge Parish.

Screening models were used to determine estimated concentrations of diuron in surface water.

Ground Water

EFED has limited monitoring data on the concentrations of diuron in groundwater. Monitoring data for diuron that are available for the states of California, Florida, Georgia, and Texas showed a maximum diuron concentration of 5.37 ppb (USEPA, 1992).

The US Geological Survey (USGS) National Water Quality Assessment Program (NAWQA) analyzed pesticide occurrence and concentrations for major aquifers and shallow ground water in agricultural areas (detection limit = 0.05 ppb). Analysis of 2608 samples (major aquifers study) showed diuron in 71% of the samples analyzed with a maximum concentration of 0.34 ppb. Maximum diuron concentration in 897 samples from shallow groundwater sites was 2.0 ppb, with diuron detected in only 1.23% of samples analyzed (USGS, 1998). A major component of the sampling design in the NAWQA study was to target specific watersheds and shallow ground water areas that are influenced primarily by a single dominant land use(agricultural or urban) that is important in the particular area. The ground-water data were primarily collected from a combination of production and monitoring wells. Ground-water sites in the ground-water data were sampled for pesticides from a single snap-shot in time.

According to the Florida Department of Environmental Protection (2001), ground water samples from wells collected between 5/90 and 11/97, showed diuron detections with concentrations range from 0.94 - 12 ppb (detection limit=0.48 ppb). The arithmetic mean concentration was 2.44 ppb. Well water samples were collected from the following counties: Highlands, Jackson, Lake, Orange, and Polk. With the exception of the 12 ppb sample in Orange County, the most of the detections were in Highlands County where citrus is grown. Diuron concentrations in Highlands County decreased with time to about 1 ppb but were detected every year. In Polk County, diuron concentrations show a seasonal patter, with highest concentrations in the spring and lower concentrations in the fall, but was not detected in all years.

Even though, the groundwater monitoring data collected by NAWQA are from sites considered typical for use areas, the frequency of sampling and the length of sampling period were not sufficient temporal and spatial requirements for regulatory purposes.

The SCI-GROW model (Barrett, 1997) was used to estimate potential groundwater concentrations. The modeled GW EEC's from SCI-GROW were consistent with the State of Florida monitoring data, but were higher than the other monitoring data.

Drinking Water Recommendation

For surface water, EFED recommends to use the 1-in-10-year peak concentration from the IR-PC modeling as the acute toxicity endpoint, the 1-in-10-year annual mean concentration as the chronic non-cancer toxicity endpoint, and the mean of annual values as the cancer toxicity endpoint.

Tier II surface water modeling was done using the Index Reservoir (IR) and Percent Crop Area (PCA) modifications for diuron use on citrus (Jones et. al, 1998, and Effland et al., 2000). The modeling results indicate that diuron has the potential to contaminate surface waters used as a source of drinking water by runoff, especially in areas with large amounts of annual rainfall. The maximum diuron estimated environmental concentration was 290 ppb, chronic (non-cancer) was 67.1 ppb, and chronic (cancer) was 45.2 ppb.

For groundwater, EFED recommends using the SCI-GROW EEC's for both acute and chronic endpoints. The EEC from SCI-GROW modeling was 11.7 ppb.

ECOLOGICAL EFFECTS ASSESSMENT

SUMMARY:

Seventy ecological toxicity studies were submitted by the registrant. Forty-nine studies were classified as acceptable and fulfilling the guideline requirements. Twenty-one studies were classified as supplemental and provide the useful information for an ecological risk assessment. Some studies were conducted prior to current Pesticide Assessment Guidelines or failed to provide critical information (such as using non-recommended species or lacking of NOEC value). These studies are considered unfulfilled and must be repeated.

Diuron is sightly toxic to bobwhite quail and practically nontoxic to mallard duck on an acute oral basis. It is practically nontoxic to bobwhite quail and slightly toxic to mallard duck on a subacute dietary basis. Diuron is relative nontoxic to both honey bees and laboratory rats. In the rat chronic study, diuron caused pop body weight loss. No avian reproduction study was submitted by the registrant and it is required because diuron is persistent in the environment (Table 2).

Table 2. Summary of acute and chronic terrestrial toxicity estimates using technical diuron

Species	Acute Toxicity				Chronic Toxicity	
	Acute LD_{50} (mg/kg)	Acute Oral Toxicity (MRID)	Subacute LC_{50} (ppm)	Subacute Dietary Toxicity (MRID)	NOEC/LOEC (ppm) (MRID)	Affected endpoint
Northern bobwhite quail *Colinus virgianus*	940	Slightly toxic (50150170)	>5000	Practically nontoxic (00022923)	--	--
Mallard duck *Anas platyrhynchous*	>2000	Practic. nontoxic (00160000)	1730	Slightly toxic (00022923)	--	--
Honey bee *Apis meliferus*	145*	Practic. nontoxic (00036935)	--	--	--	--
Laboratory rat *Rattus norvegicus*	M) 5000 F) 10000	Class. III (00146145)	--	--	NOEC =250 LOEC = 1750 (00146145)	Pup body weight

* µg/bee

Diuron is moderately toxic to the majority of aquatic animals tested (including rainbow trout, bluegill sunfish, water flea, striped mullet, sheepshead minnow, Eastern oyster, and brown shrimp). However, it is highly toxic to cutthroat trout and scuds and slightly toxic to fathead minnow In chronic studies, diuron reduced number of survival (fathead minnow), growth/survival (sheepshead minnow), and growth/reproduction (mysid shrimp). Water flea and sheepshead chronic studies failed to provide the NOEC values requiring the studies to be repeated (Table 3).

Table 3. Summary of acute and chronic aquatic toxicity estimates using technical grade diuron

Species	Acute Toxicity			Chronic Toxicity	
	96-hr LC_{50} (ppm)	48-h EC_{50} (ppm)	Acute Toxicity (MRID)	NOEC/LOEC (ppm)	Affected Endpoint (MRID)
Rainbow trout *Oncorynchus mykiss*	1. 95	–	Moderately toxic (STODIV04)	–	--
Bluegill sunfish *Lepomis microchirus*	2. 8	–	Moderately toxic (40098001)	--	--
Fathead minnows *Pimephales promelas*	14. 2	–	Slightly toxic (00141636)	NOEC =0. 0264 LOEC = 0.0618	# of survivor (00141636)
Cutthroat trout *Oncerynchus clarki*	0.71	–	Highly toxic (40098001)	–	--
Scud *(Gammmarus fasciatus)*	–	0.16	Highly toxic (40094602)	–	--
Water flea *Daphnia magna*	–	1.4	Moderately toxic (40094602)	NOEC =<0. 2 LOEC = 0. 2	No effect (STODIV05)
Striped mullet *Mugil cephalus*	6.3	–	Moderately toxic (40228401)	–	--
Sheepshead minnow *Cypprinoden varieggatus*	6.7	–	Moderately toxic (41418805)	NOEC = < 0. 44 LOEC = 0.44	Reduced growth, survival (42312901)
Eastern oyster *Crassostrea virginica*	–	4.9	Moderately toxic (42217201)	–	--
Mysid shrimp *Americamysis bahia*	--	–	–	NOEC =0. 27 LOEC = 0. 56	Growth Reproduction
Brown shrimp *Penaeus aztecus*	–	>1	Moderately toxic (40228401)	–	–

Tier II terrestrial plant seedling emergence and vegetative vigor toxicity studies were conducted by the registrant with four species of monocotyledonous plants (including corn) and six species of dicotyledonous plants (including soybean). The crops selected were corn, onion, sorghum, and wheat for monocotyledonous plants; and pea, soybean, rape, cucumber, sugar beet, and tomato for dicotyledonous plants. The results showed that onion and tomato were most sensitive species for seedling emergence; and wheat and tomato were most sensitive species for plant vegetative vigor, representing monocotyledonous and dicotyledonous family, respectively. Terrestrial plants were more sensitive to vegetative vigor testing and tomato is more sensitive than its monocotyledonous counterparts.

For Tier II nontarget aquatic plant toxicity testing, the registrant tested fifteen species of nonvascular plant including aquatic algae and diatom. However, only one study with green algae (*Selenastrum capricornutum;* EC50 = 2.4 ppb) is acceptable and the remaining studies are supplemental (Table 4).

Table 4. Summary of nontarget terrestrial plant seedling emergence/vegetative vigor toxicity estimates using formulated diuron (Endpoint affected = Shoot dry weight)

Species	Seedling emergence toxicity	Vegetative vigor toxicity
	Crop	Crop
	EC50/EC05 (lbs. ai/A)	EC50/EC05 (lbs. ai/A)
Monocot	Onion	Wheat
	0.099/ 0.089	0.021/ 0.002
Dicot	Tomato	Tomato
	0.08 /0.047	0.002/ 0.001

AQUATIC EXPOSURE ASSESSMENT

Aquatic exposure assessment

Diuron aquatic EECs were estimated using EFED's Tier I surface water model GENEEC II. The EEC values of various crops and durations using aerial or ground application rates are summarized in Table 5. These values will be used for an aquatic risk assessment by calculating acute and chronic RQ values for various aquatic organisms. The values are conservative high-end EECs.

Table 5. Diuron EECs for various crops using GENEEC (ppb)

End-uses	Aerial			Ground		
Agricultural						
	Peak	21 d. avg	60 d. avg	Peak	21 d. avg	60 d.. avg
grape	-	-	-	329.85	266.38	186.93
citrus	-	-	-	219.9	177.58	124.62
Alfalfa	116.40	94.00	65.97	109.95	88.79	62.31
Fruits (Peach, Apple, Pear)	-	-	-	137.44	110.99	77.89
Sugarcane	116.4	94.00	65.97	109.95	88.79	62.31
Cotton	58.2	47.00	32.98	54.97	44.40	31.15
Non-Agricultural						
	Peak	21 d. avg	60 d. avg	Peak	21 d. avg	60 d.. avg
Railroad	436.54	352.99	248.16	412.31	332.97	233.66

Roadside, utilities, irrigation, drainage ditch	-	-	-	412.31	332.97	233.66

The Tier II surface water model PRZM/EXAMS was used to obtain more realistic EECs with grape (CA), citrus (FL) and apple (NY) scenarios. These scenarios were chosen to reflect a wide range of application rates and weather conditions. PRZM-EXAMS and GENEEC2 EECs are listed in Table 6. GENEEC's EECs are generally greater than those of PRZM/EXAMS and also depend on regional vulnerability. For the use of diuron on grapes in CA at 9.6 lbs ai/A, GENEEC's EECs were 5.2-8.4 times higher than those from PRZM/EXAMS. For Fl citrus and NY apples, GENEEC 2 EEC's were 0.95-1.6 and 1.6-2.6 times those for PRZM-EXAMS, respectively.

Table 6. GENEEC VS. PRZM/EXAMS EEC's FOR DIURON ON VARIOUS CROP

Crop Scenario	Application Rate (lb ai/acre)	Method of Appl.	No. of Appl.	EEC (ppm)					
				GENEEC			PRZM/EXAMS		
				peak	21 d.	60 d.	peak	21 d.	60 d.
CA-Grape	9.6	Ground	1	0.329	0.266	0.186	0.039	0.038	0.036
FL-Citrus	6.4	Ground	1	0.219	0.177	0.125	0.138	0.133	0.130
NY-Apple	4.0	Ground	1	0.137	0.111	0.080	0.053	0.052	0.051

ECOLOGICAL RISK ASSESSMENT

To evaluate the potential ecological risk to nontarget organisms from the use of diuron products, risk quotients (RQs) are calculated from the ratio of estimated environmental concentrations (EEC) to ecotoxicity values. RQs are then compared to level of concern (LOC) used by OPP to indicate potential risk to nontarget organisms and the need to consider risk management action. When available, field studies and incident data are used to substantiate EFED's concern of diuron's risk to nontarget organisms.

Nontarget Terrestrial Animals

The estimated environmental concentrations (EEC) values used for terrestrial exposure are derived from the Kenaga nomograph, as modified by Fletcher et al. (1994), based on a large set of actual field residue data. The upper limit values from the nomograph represent the 95th percentile of residues from actual field measurements (Hoerger, 1972). The Fletcher et al. (1994) modification to the Kenaga nomograph are based on measured field residues from 249 published research papers, including 118 various species of plants, 121 pesticides, and 17 chemical classes . These modifications represent the 95th percentile of the expanded data set. Risk quotients are based on the most sensitive LC_{50} and NOAEC for birds (in this instance, mallard ducks and bobwhite quail) and LD_{50} for mammals (based on lab rat studies) as shown in Table 7.

Acute, acute restricted and acute endangered species LOCs are exceeded for birds feeding on short and tall grasses and broad leaf plant/insects at the sites with high application rates. Their rates range from 6.4 to 12 lbs ai/a (i.e., at non-agricultural, grape and citrus sites with one or two applications of 4.8 lbs ai/A) and calculations based on maximum EECs. However, RQ values do not exceeded LOCs if calculations are based on average EECs. The acute endangered species LOC was exceeded for birds feeding on every food items except seeds based on maximum EECs. Avian chronic RQ's are not assessed due to a lack of acceptable data (Table 7).

Table 7. Avian Acute Risk Quotients for Single and Multiple Application of Nongranular Products (Broadcast) Based on a mallard duck LC50 of 1730 ppm.

Site/Application Method App. Rate (lbs ai/A) (# of appl.)	Food Items	Maximum Acute RQ	Average Acute RQ
Single application			
Railroad/right of way Aerial/Ground appl.. 12	Short grass	1.66 [a]	0.19 [c]
	Tall grass	0.76 [a]	0.07
	Broadleaf plants/Insects	0.94 [a]	0.08
	Seeds	0.10 [c]	0.01
Grape /Ground app 9.6	Short grass	1.33 [a]	0.15 [c]
	Tall grass	0.61 [a]	0.06
	Broadleaf plants/Insects	0.75 [a]	0.06
	Seeds	0.08	0.01
Citrus Ground app. 6.4	Short grass	0.89 [a]	0.10 [c]
	Tall grass	0.41 [b]	0.04
	Broadleaf plants/Insects	0.50 [a]	0.04
	Seeds	0.06	0.00
Fruits Ground app. 4.0	Short grass	0.55 [a]	0.06 [c]
	Tall grass	0.25 [b]	0.02
	Broadleaf plants/Insects	0.31	0.03
	Seeds	0.03	0.00
Alfalfa Sugar cane Grass seeds Aerial/Ground appl. 3.2	Short grass	0.44 [b]	0.05
	Tall grass	0.20 [b]	0.02
	Broadleaf plants/Insects	0.25 [b]	0.02
	Seeds	0.03	0.0
Cotton Aerial/Ground app. 1.6	Short grass	0.22 [b]	0.02
	Tall grass	0.10	0.01
	Broadleaf plants/Insects	0.12	0.01
	Seeds	0.01	0.00

a exceeds acute high, acute restricted and acute endangered species LOC's
b exceeds acute restricted and acute endangered species LOC's.
c exceeds acute endangered species LOC's.

Table 7 (cont.). Avian Acute Risk Quotients for Single and Multiple Application of Nongranular Products (Broadcast) Based on a mallard duck LC50 of 1730 ppm

Multiple application

Site/App. Method App. Rate (lbs ai/A) (# of appl.)	Food Items	Maximum Acute RQ	Average Acute RQ
Citrus	Short grass	1.26 [a]	0.14 [c]
4.8 (2)	Tall grass	0.58 [a]	0.05
	Brad leaf plant /Insects	0.71 [a]	0.06
	Seeds	0.08	0.01
Sugarcane	Shortgrass	0.84 [a]	0.09
3.2 (3)	Tall grass	0.39 [b]	0.04
	Brad leaf/plant insects	0.47 [b]	0.04
	Seeds	0.05	0.00
Cotton	Shortgrass	0.32 [b]	0.04
1.2 (2)	Tall grass	0.14	0.01
	Brad leaf plant/Insects	0.18	0.01
	Seeds	0.02	0.00

a exceeds acute high, acute restricted and acute endangered species LOCs.
b exceeds acute restricted and acute endangered species LOCs.
c exceeds acute endangered species LOCs.

Acute, acute restricted and acute endangered species LOCs was exceeded for small mammals feeding on short grass (Table 8). The majority of chronic RQ values for mammals feeding on short and tall grasses, and broadleaf plants/insects exceeded chronic LOC regardless of which EECs are used (Table 9).

Table 8. Acute RQ values for small (15g), intermediate (35 g) and large (1,000 g) mammals feeding on short or tall grass, broadleaf plants/insects, and seeds exposed to diuron following single and multiple applications.

Site Appl. rate (ai lbs) (# of appl)	Body weight (g)	RQ Short Grass	RQ Tall Grass	RQ Broad leaf Plants/Insects	RQ Seeds
Non-agriculture 12 (1)	15	0.55 [a]	0.31 [b]	0.03	0.01
	35	0.38 [b]	0.22 [b]	0.02	0.01
	1000	0.09 [c]	0.05	0.01	< 0.01
Grape/ground 9.6 (1)	15	0.44 [b]	0.25 [b]	0.03	< 0.01
	35	0.31 [b]	0.17 [c]	0.02	< 0.01
	1000	0.07 [c]	0.04	<0.01	< 0.01
Citrus/ground *6.4 (1)*	15	0.29 [b]	0.17 [c]	0.02	< 0.01
	35	0.20 [b]	0.11 [c]	0.01	< 0.01
	1000	0.05	0.03	<0.01	< 0.01
Fruits/ground *4.0 (1)*	15	0.18 [c]	0.10 [c]	0.01	< 0.01
	35	0.13 [c]	0.07	0.01	< 0.01
	1000	0.03	0.02	<0.01	< 0.01
Alfalfa/sugarcane/grass seeds 3.2 (1)	15	0.15 [c]	0.08	0.01	< 0.01
	35	0.10 [c]	0.06	0.01	< 0.01
	1000	0.02	0.01	<0.01	< 0.01
Cotton /aerial 1.6 (1)	15	0.07	0.04	<0.01	< 0.01
	35	0.05	0.03	<0.01	< 0.01
	1000	0.01	0.01	<0.01	< 0.01
Citrus/Ground 4.8 (2)	15	0.44 [b]	0.25 [b]	0.03	< 0.01
	35	0.31 [b]	0.17 [c]	0.02	< 0.01
	1000	0.07	0.04	<0.01	< 0.01
Sugarcane/aerial 3.2 (3)	15	0.44 [b]	0.25 [b]	0.03	< 0.01
	35	0.31 [b]	0.17 [c]	0.02	< 0.01
	1000	0.07	0.04	<0.01	< 0.01
Cotton/aerial 1.2 (2)	15	0.11 [c]	0.06 [c]	0.01	< 0.01
	35	0.08	0.04	0.00	< 0.01
	1000	0.02	0.01	<0.00	

a exceeds acute high, acute restricted and acute endangered species LOCs
b exceeds acute restricted and acute endangered species LOCs.
c exceeds acute endangered species LOCs.

Table 9. Chronic RQ values for mammals feeding on short grass, tall grass, broadleaf plants/insects, and seeds exposed to diuron following multiple applications.

Site Appl. rate (ai lbs) (# of appl)	Source of EEC	RQ Short Grass	RQ Tall Grass	RQ Broad leaf Plants/Insects	RQ Seeds
Citrus/Ground 4.8 (2)	Max. Chronic 1/	9.22 [d]	4.22 [d]	5.18 [d]	0.58
	Max. Chronic 2/	8.73 [d]	4.00 [d]	4.91 [d]	0.55
	Average chronic 2/	3.09 [d]	1.31 [d]	1.64 [d]	0.25
Sugarcane/aerial 3.2 (3)	Max. Chronic 1/	9.22 [d]	4.22 [d]	5.18 [d]	0.58
	Max. Chronic 2/	5.82 [d]	2.67 [d]	3.27 [d]	0.36
	Average chronic 2/	2.06 [d]	0.87	1.09 [d]	0.17
Cotton/aerial 1.2 (2)	Max. Chronic 1/	2.11 [d]	0.97	1.19 [d]	0.13
	Max. Chronic 2/	2.18 [d]	1.00 [d]	1.23 [d]	0.14
	Average chronic 2/	0.77	0.33	0.41	0.06

1/ From Hoerger & Kenaga nomograph 2/ Estimation of maximum chronic value using Fate model
d exceeds chronic LOCs

Nontarget Aquatic Animals

For freshwater fish exposed to EECs based on GENEEC, the proposed major uses of diuron (except non-agricultural uses) will not exceed acute LOCs, but will exceed restricted use and endangered species LOCs. However, all freshwater fish chronic RQ values (except on cotton with two applications of 1.2 lbs ai/A) exceed both endangered and non-endangered species chronic level of concern. For freshwater invertebrates, all acute RQ values exceeded LOCs for both endangered and non-endangered species (except cotton and sugarcane uses). However, chronic freshwater invertebrate RQs were exceeded for both endangered and non-endangered species only with non-agricultural, grape and citrus uses between 4.8 and 12 lbs ai/A.

EFED also calculated risk quotients using the toxicity levels of concern and EEC's from the Tier II surface-water runoff model PRZM/EXAMS for grape, citrus, and apple sites. For freshwater fish, the RQ values ranged from 0.19 to 0.46 and 1.36 to 4.92 for acute and chronic risks, respectively. For freshwater invertebrates, they were 0.24 to 0.86 and 0.19 to 0.67 for acute and chronic effects, respectively. Among these high rate use sites, the RQ's that exceeded the LOC's for freshwater invertebrates was reduced from 3 to 1 and from 1 to 0 for acute and chronic effects, respectively.

There was no change in the number of exceedences of LOC's for freshwater fish chronic effects (Table 10).

Table 10. Acute and Chronic Risk Quotients for Freshwater Fish and Invertebrate Exposed to Diuron

Crop/Appl method	EECs (ppm)	Acute Risk Quotients		Chronic Risk Quotients	
Application rate, lbs (# of appl.)	Peak 21-day average 60-day average	Freshwater Fish Cutthroat trout LC_{50} = 0.71 ppm.	Freshwater Invert. Scuds LC_{50} =0.16 ppm	Freshwater Fish Fathead minnow NOEC =0.0264	Freshwater Invert. Water flea NOEC =0.2 ppm
Non-agriculture 12 (1)	0. 412 0. 353 0.234	0. 58 [a] – –	2. 58 [a] – –	– – 9. 00 [d]	– 1.77 [*d] --
Grape/ground 9.6 (1)	0. 330 (0.039) 1/ 0. 266 (0.038)1/ 0.187 (0.036)1/	0.46 [b] (0.05)2/ – –	2. 06 [a] (0.24)2/ – --	– – 7. 19 [d] (1.36 [d]) 2/	– 1.33 [*d] (0.19)2/ --
Citrus/ground 6.4 (1)	0. 220 (0.138)1/ 0.178 (0.133)1/ 0.125 (0.130)1/	0.31 [b] (0.19)2/ – --	1.38 [a] (0.86 [a])2/ – --	– – 4.81 [d] (4.92 [d])2/	– 0.89 (0.67)2/ --
Fruits/ground 4.0 (1)	0.137 (0.053)1/ 0.094 (0.052)1/ 0.078 (0.051)1/	0.19 [b] (0.07)2/ – --	0.86 [a] (0.33)2/ – --	– – 3.00 [d] (1.93 [d]) 2/	– 0.47 (0.26) --
Alfalfa/sugarcane/grass seeds 3.2 (1)	0116 0.111 0.066	0.16 [b] – –	0.73 [a] – –	– – 2.54 [d]	– 0.56 --
Cotton /aerial 1.6 (1)	0.058 0.047 0.033	0.08 [c] – –	0.36 [b] – --	– – 1.27 [d]	– 0.24 --
Citrus/Ground 4.8 (2)	0.091 0.247 0.052	0.13 [b] – –	0.57 [a] – --	– – 2.00 [d]	– 1.24 --
Sugarcane/aerial 3.2 (3)	0.061 0.163 0.035	0.09 [c] – –	0.38 [b] – –	– – 1.35 [*d]	– 0.82 –
Cotton/aerial 1.2 (2)	0.022 0.061 0.031	0.03 – –	0.14 [b] – –	– – 0.50	– 0.31 --

a exceeds acute high, acute restricted and acute endangered species LOCs. 1/ EEC based on PRZM/EXAMS run. 2/ RQ based on PRZM/EXAMS run.
b exceeds acute restricted and acute endangered species LOCs.
c exceeds acute endangered species LOCs.
d exceeds chronic LOCs.

Neither acute nor chronic RQ s for estuarine/marine animals exceeds acute or chronic level of concerns except for chronic RQ of invertebrates at non-agricultural sites. However, restricted use or endangered species LOC's were exceeded for esturarine invertebrates and endangered species LOC's only for estuarine fish with both non-agricultural and grape uses (Table 11).

Table 11. Acute and Chronic Risk Quotients for Estuarine/Marine Fish and Invertebrate Exposed to Diuron

Crop/ Appl method Application rate lbs (# of appl.)	EECs (ppm) Peak 21-day average 60-day average	Acute Risk Quotients Estuarine Fish Striped mullet LC_{50} = 6. 3 ppm.	Acute Risk Quotients Estuarine Invertebrate Brown shrimp LC_{50} =6. 3 ppm	Chronic Risk Quotients Estuarine Fish Sheepshead minnow NOEC =0.44	Chronic Risk Quotients Estuarine Invertebrate Mysid shrimp NOEC =0.27 ppm
Non-agriculture 12 (1)	0. 412 0. 353 0.234	0. 07 [c] – –	0.412 [b] – –	– – 0.53	– 1.31[a] --
Grape/ground 9.6 (1)	0.330 (0.039) 1/ 0. 266 (0.038)1/ 0.187 (0.036)1/	0.05 [c] (0.006) – –	0.330 [b] (0.039) – --	– – 0.43 (0.08)	– 0.99 (0.14) --
Citrus/ground 6.4 (1)	0. 220 (0.138)1/ 0.178 (0.133)1/ 0.125 (0.130)1/	0.03 (0.022) – --	0.220 [b] (0.138) – --	– – 0.28 (0.30)	– 0.06 (0.49) --
Fruits/ground 4.0 (1)	0.137 (0.053)1/ 0.094 (0.052)1/ 0.078 (0.051)1/	0.02 (0.008) – --	0.137 [b] (0.053) – --	– – 0.18 (0.12)	– 0.35 (0.15) --
Alfalfa/sugarcane/grass seeds 3.2 (1)	0116 0.111 0.066	0.02 – –	0.116 [b] – –	– – 0.15	– 0.41 --
Cotton /aerial 1.6 (1)	0.058 0.047 0.033	0.01 – –	0.058 [c] – --	– – 0.08	– 0.17 --
Citrus/Ground 4.8 (2)	0.091 0.247 0.052	0.01 – –	0.091 [c] – --	– – 0.12	– 0.91 --
Sugarcane/aerial 3.2 (3)	0.061 0.163 0.035	0.01 – –	0.061 [c] – –	– – 0.08	– 0.6 --
Cotton/aerial 1.2 (2)	0.022 0.061 0.031	0.01 – –	0. 023 – –	0.03 – –	– – 0.23

a exceeds acute high, acute restricted and acute endangered species LOCs
b exceeds acute restricted and acute endangered species LOCs.
c exceeds acute endangered species LOCs
d exceeds chronic LOCs.

1/ EEC based on PRZM/EXAMS run.

Nontarget Plants

Table 12. Seedlings Emergence and Vegetative vigor Risk Quotients from a Single Application for Terrestrial Plants in Dry and Semi-Aquatic Area Based on a Tomato Emergence EC25 of 0.08 lbs/A and a Tomato Vegetative Vigor EC05 of 0.002 lbs ai/A.

Site App. Rate (# ai/A)	Acute Risk Emergence RQ Dry Area 1/	Acute Risk Emergence RQ Semi-aquatic 2/	Acute Risk Vegetative Vigor RQ Dry + Semi aquatic3/	Acute Endangered Species Risk Emergence RQ Dry Area 4/	Acute Endangered Species Risk Emergence RQ Semi-aquatic 5/	Acute Endangered Species Risk Vegetative vigor RQ Dry + Semi aquatic 6
Ground Application						
Non-agriculture 12	9.00 a	76.50 a	5.00 a	36.00 a	306.00 a	20.00 a
Grape 9.6	7.25 a	61.25 a	5.00 a	29.00 a	245.00 a	20.00 a
Citrus 6.4	4.75 a	40.75 a	5.00 a	19.00 a	163.00 a	20.00 a
Alfalfa/Sugarcane/Grass seeds 3.2	2.38 a	20.38 a	5.00 a	9.50 a	81.50 a	20.00 a
Cotton 1.6	1.25 a	10.25 a	5.00 a	5.00 a	41.00 a	20.00 a
Aerial Application						
Non-agriculture 12	12.00 a	52.50 a	25.00 a	48.00 a	210.00 a	100.00 a
Citrus 9.6	9.63 a	42.25 a	25.00 a	38.50 a	169.00 a	100.00 a
Alfalfa/Sugar-cane 3.2	3.25 a	14.50 a	25.00 a	13.00 a	58.00 a	100.00 a
Cotton 1.6	1.63 a	7.25 a	25.00 a	6.50 a	29.00 a	100.00 a

1/ (Dry area EEC) ÷ (Emergency EC25)
2/ (Semi-aq area EEC) ÷ (Emergency EC25)
3/ (Dry +Semi-aq area EEC) ÷ (Vegetative vigor EC25)
4/ (Dry area EEC) ÷ (Emergency EC05)
5/ (Semi-aq area EEC) ÷ (Emergency EC05)
6/ (Dry +Semi-aq area EEC) ÷ (Vegetative vigor EC05)
a exceeds acute high, acute restricted and acute endangered species LOC's

Runoff RQs(from both dry and semi-aquatic areas) and drift RQs (from both areas), based on the most sensitive monocot and dicot EC25 and EC05, exceeded acute and acute endangered species LOCs. The RQs ranged from 1.25 to 76.5 for acute risk and 5 to 306 for risk to endangered species (Table 12).

Table 13. Acute Risk Quotients for Aquatic Plants based upon a nonvascular plant (*Skeletonema costatum*) EC_{50} of 0.0024 ppm ai.

Site/ Application Method/ Rate of Application (lbs ai/A)	EEC (ppm)	Non-target plant RQ (EEC/EC_{50})
Railroad/right of way aerial/ground 12 (1)	0.412	171.67 [a]
Grape/ Ground 9.6 (1)	0.330	137.50 [a]
Citrus/Ground 6.4 (1)	0.220	91.67 [a]
Fruits/ground 4.0 (1)	0.137	57.08 [a]
Alfalfa/sugarcane/ grass seeds/sugarcane aerial 3.2 (1)	0.116	48.33 [a]
Cotton/ aerial 1.6 (1)	0.058	24.17 [a]
Citrus/Ground 4.8 (2)	0.091	37.92 [a]
Sugarcane/aerial 3.2 (3)	0.061	25.42 [a]
Cotton/aerial 1.2 (2)	0.023	9.58 [a]

a exceeds acute high LOCs

Fifteen aquatic plant Tier II toxicity studies were submitted by the registrant. However, 14 studies used non-standard plant species. EFED's standard procedure is to conduct an aquatic plant risk assessment using the most sensitive specie of the five required species. However, only the green algae (*Skeletonema costatum)* EC50 study is core. The green algae study is being used for aquatic plant risk assessment because it is the only standard specie, and was the most sensitive specie of the 15 tested plants. Due to lack of data, EFED does not know if green algae will be the most sensitive aquatic plant specie. Therefore, the EC_{50} value for the most sensitive nonvascular species is still undetermined. The acute EC_{50} study for the vascular aquatic plant duckweed, remains a data gap. The results of green algae Tier II toxicity study shows that its RQs exceeded acute LOCs for all sites. Their RQ values range from 9.58 to 171.67 (Table 13).

ENDANGERED SPECIES

Endangered species LOCs for diuron are exceeded for terrestrial plants for all uses, herbivorous mammals, and herbivorous and insectivorous birds from all uses; freshwater fish and crustaceans from all uses but cotton; and mollusks and estuarine fish from the uses on grapes and non-agricultural sites. The Agency consulted with the US Fish and Wildlife Service (FWS or the Service) on the agricultural uses of diuron in the "reinitiation" of the cluster assessments in 1988. The resulting 1989 opinion found jeopardy to the Wyoming toad (extirpated in the wild except on FWS refuges). The Service proposed a Reasonable and Prudent Alternative (RPA) (no spray zone within 100 yards of occupied habitat for ground applications and 1/4 mile for aerial application) to avoid the likelihood of jeopardizing the continued existence of this species. In addition, the Service had Reasonable and Prudent Measures (RPM) to reduce incidental take of 20 fish and two aquatic invertebrate species. The details of the RPM recommendations are provided in the FWS 1989 biological opinion.

Many additional species, especially aquatic species, have been federally listed as endangered/threatened since the biological opinion of 1989 was written, and determination of potential effect to these species has not been assessed for diuron. In addition, endangered plants, birds and mammals were not considered in the 1989 opinion and need to be addressed. The biological opinion only covered the crops applications of diuron. The nonagricultural uses such as rights-of ways, ditch banks, railroads were not addressed. As the highest application rates occur on these non-agricultural sites, these uses also need to be considered in any reinitiation. Finally, not only are more refined methods to define ecological risks of pesticides being used but also new data, such as that for spray drift, are now available that did not exist in 1989. The RPMs in the 1989 opinion may need to be reassessed and modified based on these new approaches.

The Agency is currently engaged in a Proactive Conservation Review with FWS and the National Marine Fisheries Service under section 7(a)(1) of the Endangered Species Act to clarify and develop consistent processes for endangered species risk assessments and consultations. Subsequent to the completion of this process, the Agency will reassess both those species listed since the completion of the biological opinion and those not considered in the opinion. The nonagricultural uses will also be considered at this time. The Agency will also consider regulatory changes recommended in the RED when we undertake this reassessment.

The Agency has developed the Endangered Species Protection Program to identify pesticides whose use may cause adverse impacts on endangered and threatened species, and to implement mitigation measures that address these impacts. The Endangered Species Act requires federal agencies to ensure that their actions are not likely to jeopardize listed species or adversely modify designated critical habitat. To analyze the potential of registered pesticide uses to affect any particular species, EPA puts basic toxicity and exposure data developed for REDs into context for individual listed species and their locations by evaluating important ecological parameters, pesticide use information, the geographic relationship between specific pesticides uses and species locations, and biological requirements and behavioral aspects of the particular species. This analysis will include consideration of the regulatory changes recommended in this RED. A determination that there is a likelihood of potential impact to a listed species may result in limitations on use of the pesticide, other measures to mitigate any potential impact, or consultations with the Fish and Wildlife Service and/or the National Marine Fisheries Service as necessary.

At present, the program is being implemented on an interim basis as described in a Federal Register notice (54 FR 27984-28008, July 3, 1989). A final program, which may be altered from the interim program, will be proposed in a Federal Register notice scheduled for publication in autumn of 2001.

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APPENDIX 1

SUMMARY OF SUBMITTED ENVIRONMENTAL FATE STUDIES

Degradation

Satisfied:

161-1 Hydrolysis ; MRID# 41418804. Diuron was stable to hydrolysis in buffered, sterilized solutions at pH 5, 7, and 9 after 30 days at 25 ± 1 °C in the dark. The very small amount of degradation that occurred (less than 4% of applied radioactivity) yielded extremely extrapolated half-lives of >500 days in each test solution. A minor degradate (0.5% of applied radioactivity) in all test solutions was identified as 3,4-dichloroaniline (3,4-DCA).

161-2 Photodegradation in Water; MRID# 41418805. Diuron photodegrades in water with a half-life of 9 days (about 43 days under natural sunlight) after exposure for 15 days (continuos irradiation; equivalent to 70 days of discontinuous irradiation [12 hours light and 12 hours dark] to Xenon light. Degradates were CO_2 and at least 13 minor (each is < 9% of applied radioactivity) polar products. There was no degradation in the dark controls.

161-3 Photodegradation in Soil; MRID# 41719302. Uniformly ring-labeled ^{14}C-diuron degraded with a calculated half-life of 173 days on silt loam soil irradiated on a 12-hour photoperiod with a Xenon arc lamp at 25 °C for 30 days. The major degradate was N'-(3,4-dichlorophenyl)-N-methylurea (DCPMU). The minor degradates demethylated DCPMU (DCPU), dichloroaniline (DCA), and 3,3',4,4'-tetrachlorobenzene (TCAB) were also identified. Diuron did not degrade in the dark control samples.

Metabolism

162-1 Aerobic Soil Metabolism; MRID# 4179303. ^{14}C-Diuron degraded with a half-life of 372 days in a non-sterilized aerobic silt loam soil that was incubated in darkness at 25 °C for one year. The half-life in the sterilized soil was 1920 days. The degradates identified were N'-(3,4 dichlorophenyl)-N-methylurea (DCPMU) and N'-(3,4-dichlorophenyl)urea (DCPU). DCPMU reached 20.9-22.5 % of the applied by the end of the study (365 days) and was the only significant degradate. $^{14}CO_2$ comprised 3.36% of the applied radioactivity by 365 days posttreatment.

162-2 Anaerobic Soil Metabolism; MRID# 41418806. ^{14}C-Diuron (at 8.27 ppm equivalent to maximum field application rate of 10 lb ai/A) degraded very slowly under anaerobic conditions ($t_{1/2}$

33

= 1000 days) in silt loam soil. The only degradate identified was DCPMU, which accounted for a maximum of 10.3% of applied radioactivity after 45 days of anaerobic incubation; diuron was 89.7% at this time. The half life under aerobic conditions was not calculated, but DCPMU was present at 13% after 30 days; the parent was 87% at this time.

162-3 Anaerobic Aquatic Metabolism; MRID# 44221001. Diuron degraded with a calculated half-life of 5 days in a clay loam sediment:water system that was incubated under anaerobic conditions at 25 ± 2 °C in darkness for up to 370 days. Three degradates were identified: N'-(3-chlorophenyl)-N,N-dimethylurea (mCPDMU); 1,1-dimethyl-3-phenylurea (PDMU); and N-(3-chlorophenyl)-N'-methylurea (mCPMU). Parent diuron was mainly associated with the soil, and the predominant degradate mCPDMU was mainly associated with the aqueous phase. PDMU and mCPMU were minor degradates

162-4 Aerobic Aquatic Metabolism; MRID#44221002. Diuron degraded with a half-life of 33 days in a an aerobic non-sterile clay loam sediment:water system that was incubated at 25 °C in darkness for up to 30 days. The predominant degradate mCPDMU reached 25 % of the applied dose by the end of the study, and was evenly distributed between the soil and aqueous phase. The identified minor degradates were DCPMU and demethylated mCPDMU (CPMU), and were primarily associated with the soil.

164-1 Terrestrial Field Dissipation; MRID# 44654001, 44865001. Diuron was applied in a single application at 12 lb ai/acre to bare ground plots in FL, MS, and CA with sand, silt loam, and silty clay loam soils, respectively. The reviewer-calculated half-lives were 73, 139, and 133 days, respectively. The major degradate, DCPMU, dissipated in the same plots with reviewer-calculated half-lives of 217, 1733, and 630 days, respectively.

164-2 Aquatic Field Dissipation; MRID# 43762901. Diuron (Karmex® DF, 80% a.i.), broadcast applied once at a nominal application rate of 12.0 lb a.i./A onto the bare ground slope and berm of a channel plot of clay soil in California, dissipated with reviewer-calculated half life of 177 days (r^2 = 0.38). The major degradate DCPMU was detected in the 0- to 15-cm depth of the berm soil at 0.049 ppm immediately following application.

Aquatic Field Dissipation; MRID# 43978901.Diuron (Karmex® DF, 80% a.i.), broadcast applied once at a nominal application rate of 12.0 lb. a.i./A onto the bare ground berm and slope of a drainage ditch plot of silt loam soil, dissipated with a reviewer-calculated half life of 115 days (r^2 = 0.5; slope and berm soil combined) in berm and slope soil. In the 0- to 15-cm soil berm depth, the major degradate DCPMU was detected with a maximum of 0.45 ppm at 91 days.

Mobility

163-1 Leaching/Adsorption/Desorption; MRID# (MRID No. 444490501). Uniformly phenyl ring-labeled [^{14}C]diuron, at nominal concentrations of 0.1, 0.5, 1.0 and 5.0 µg/mL, was studied in Chino loam, Barclay silty clay loam, and Keyport silt loam soil:solution slurries that were equilibrated for >12 hours at 22 ± 3°C. Freundlich K_{ads} values were 14 for the loam soil (1.4% o.m.), 7.9 for the silty clay loam soil, and 28 for the silt loam soil (7.7% o.m.); corresponding K_{oc} values were 1666, 468, and 626 mL/g. Material balances were not reported for samples utilized in the definitive study. This study could be ungraded upon the submission of material balances information.

APPENDIX 2

SCI-GROW, GENEEC2, and PRZM-EXAMS Inputs and Outputs
GENEEC FOR ECOLOGICAL EFFECTS AND DRINKING WATER ASSESSMENTS

Background Information on SCI-GROW

The Environmental Fate and Effects Division of USEPA's Office of Pesticide Programs (OPP) uses a tiered system of pesticide exposure modeling to assess risk of a pesticide product to the environment. This tiered system is designed to minimize the amount of analysis which is required to register any given chemical. Each tier is designed to screen out pesticides by requiring higher, more complex levels of investigation only for those that have not passed the next lower tier. Each tier screens out a percentage of pesticides from having to undergo a more rigorous pre-registration review.

SCI-GROW, the first tier is designed as a coarse screen and estimates expected concentrations from a few basic chemical parameters and pesticide label application information. Tier 1 is used to screen chemicals to determine which ones potentially pose sufficient risk to warrant higher level assessment.

The Tier 1 model described here, the Screening Concentration in Ground Water Program (SCI-GROW), uses a regression model that uses a candidate chemical's soil/water partition coefficient and degradation half-life values to estimate groundwater concentrations arising from labeled uses at a highly vulnerable agricultural site. The program assumes pesticide application at the maximum label rate to a field that is highly vulnerable due to a rapidly permeable soil overlying shallow groundwater.

SCI-GROW MODEL INPUT PARAMETERS

Parameter	calculations/value	source
application rate (lb ai/acre)	9.6	label (EPA Reg. No. 1812-362).
interval between application. (day)	N/A	label (EPA Reg. No. 1812-362).
Max No. application	1	label (EPA Reg. No. 1812-362).
K_{oc} (mL/g)	lowest in non-sand (468)	MRID# 44490501; Input parameters guideline*
soil aerobic met. $t_{1/2}$ (d)	372	MRID# 41719303; Input parameters guideline

*: Guidance for Chemistry and Management Practice Input Parameters For Use in Modeling the Environmental Fate and Transport of Pesticide. USEPA/OPP/EFED. Version 2. Nov, 7, 2000.

SCI-GROW MODEL OUTPUT

```
RUN No.   1 FOR diuron          INPUT VALUES
--------------------------------------------------------------------
APPL (#/AC)  APPL.  URATE    SOIL   SOIL  AEROBIC
RATE          NO. (#/AC/YR)  KOC  METABOLISM (DAYS)
--------------------------------------------------------------------
  9.600      1     9.600    468.0    372.0

GROUND-WATER SCREENING CONCENTRATIONS IN PPB
--------------------------------------------------------------------
                6.521987
--------------------------------------------------------------------
A=  367.000  B=  473.000  C=   2.565  D=   2.675  RILP=   3.399
F=   -.168  G=    .679  URATE=   9.600  GWSC=    6.521987
```

Background Information on GENEEC2

GENEEC Version 2.0 is an update of GENEEC Version 1.2 (Parker et. al., 1995) which was issued by the USEPA Office of Pesticide Programs (OPP) Environmental Fate and Effects Division (EFED) in May 1995 for use in tier 1, screening level pesticide aquatic ecological risk assessments. Version 2 was developed in response to suggestions by users for improvements, by the desire to stay current with the newer versions of the PRZM (Carousel, 1997) and EXAMS (Burns, 2000) programs upon which GENEEC is based and by availability of much improved data on spray drift and quantitative methods of estimation of offsite spray drift developed by the Spray Drift Task Force (SDTF). The main differences between versions 1.2 and 2.0 include: (a) an entirely new binding curve to represent dissolved concentration as a function of K_d; (b) the use of the binding parameter, K_d in preference to K_{oc} to represent pesticide attachment to soil, to organic matter or to water-body bottom sediments; (c) changes in the recommendation for depth of incorporation; (d) a change in the timing of the single event rainstorm for chemicals which receive multiple applications; (e) addition of a subroutine from the SDTF to estimate spray drift; and (f) a change in the time durations of the output values to better match the durations of relevant toxicity tests. For additional details see, "Development and Use of GENEEC Version 2.0 for Pesticide Aquatic Ecological Exposure Assessment".

EFED uses a tiered system of pesticide exposure modeling to assess risk of a pesticidal product to the environment. This tiered system is designed to minimize the amount of analysis which is required to register any given chemical. Each of the tiers is designed to screen out pesticides by requiring higher, more complex levels of investigation only for those that have not passed the next lower tier. Each tier screens out a percentage of pesticides from having to undergo a more rigorous review prior to registration or reregistration.

The GENEEC (GENeric Estimated Environmental Concentration) model, the tier one computer program, uses a the soil/water partition coefficient and degradation kinetic data to estimate runoff from a ten hectare field into a one hectare by two meter deep "standard" pond. This first tier is designed as a coarse screen and estimates conservative pesticide concentrations in surface water from a few basic chemical parameters and pesticide label use and application information. Tier 1 is used to screen chemicals to determine which ones potentially pose sufficient risk to warrant higher level modeling. Chemicals failing to pass this program, move on to the tier two modeling. As a matter of policy, OPP does not take significant adverse regulatory action based upon the results of Tier 1 screening models.

GENEEC is a program to calculate acute and long-term estimated environmental concentration (EEC) values. It considers reduction in dissolved pesticide concentration due to adsorption of pesticide to soil or sediment, incorporation, degradation in soil before run off to a water body, direct deposition of spray drift into the water body, and degradation of the pesticide within the water body. It is designed to mimic a PRZM-EXAMS simulation

GENEEC 2.0 Runs for Diuron on various crops

RUN No. 1 FOR diuron **ON grape** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL		SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
9.600(9.600)	1	1	468.0	42.0	GRHIFI(6.6)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC

329.85 316.29 266.38 186.93 147.53

RUN No. 2 FOR diuron **ON citrus** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
6.400(6.400)	1 1	468.0	42.0	GRHIFI(6.6)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
219.90	210.86	177.58	124.62	98.35

RUN No. 3 FOR diuron **ON alfalfa** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
3.200(3.200)	1 1	468.0	42.0	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
116.40	111.62	94.00	65.97	52.06

RUN No. 4 FOR diuron **ON peaches** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
4.000(4.000)	1 1	468.0	42.0	GRHIFI(6.6)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
137.44	131.79	110.99	77.89	61.47

RUN No. 5 FOR diuron **ON sugarcane** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
3.200(3.200)	1 1	468.0	42.0	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
116.40	111.62	94.00	65.97	52.06

RUN No. 6 FOR diuron **ON cotton** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
1.600(1.600)	1 1	468.0	42.0	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
58.20	55.81	47.00	32.98	26.03

RUN No. 7 FOR diuron **ON railroads** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL		SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
12.000(12.000)	1	1	468.0	42.0	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
436.51	418.57	352.52	247.38	195.24

RUN No. 8 FOR diuron **ON roadsides** * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL		SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
12.000(12.000)	1	1	468.0	42.0	GRHIFI(6.6)	.0	.0

FIELD AND STANDARD POND HALF-LIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
1116.00	2	N/A	43.00- 5332.00	33.00	32.80

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 12/1/2000

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
412.31	395.36	332.97	233.66	184.41

Background Information on PRZM-EXAMS

There are several factors which may limit the accuracy and precision of the PRZM-EXAMS modeling.

These include the selection of the typical exposure scenarios, the quality of the input data, the ability of the models to represent the real world and the number of years that were modeled. The scenarios that are selected for use in Tier II EEC calculations are the ones that are likely to produce large concentrations in the aquatic environment. Each scenario should represent a real site to which the pesticide of concern is likely to be applied. The EEC's in this analysis are accurate only to the extent that the site represents the hypothetical high exposure site. The most limiting part of the site selection is the use of the standard pond with no outlet. A standard pond is used because it provides a basis for comparing pesticides in different regions of the country on equal terms. The models also have limitations in their ability to represent
some processes. The greatest limitation is the handling of spray drift. A second major limitation is the lack of validation at the field level for pesticide runoff.

PRZM/EXAMS RUN INPUT AND OUTPUT

IR-PCA RUN FOR DIURON ON CITRUS
INPUT FILE

```
PRZM3 Input File, flcit.inp (Jan 28 2000)
Location: Osceola County, FL.; Crop: citrus; MLRA 156A
  0.77   0.15      0  25.00     1     1
    4
  0.10   0.13   1.00  172.8          4   1.00  600.0
    1
    1   0.10  100.00  80.00     3  94  84  89   0.00  100.00
    1     3
0101 21 9 2209
0.10 0.10 0.10
.023 .023 .023
   36
  020148  030148  311248      1
  020149  030149  311249      1
  020150  030150  311250      1
  020151  030151  311251      1
  020152  030152  311252      1
  020153  030153  311253      1
  020154  030154  311254      1
  020155  030155  311255      1
  020156  030156  311256      1
  020157  030157  311257      1
  020158  030158  311258      1
  020159  030159  311259      1
  020160  030160  311260      1
  020161  030161  311261      1
  020162  030162  311262      1
  020163  030163  311263      1
  020164  030164  311264      1
  020165  030165  311265      1
  020166  030166  311266      1
  020167  030167  311267      1
  020168  030168  311268      1
  020169  030169  311269      1
  020170  030170  311270      1
  020171  030171  311271      1
  020172  030172  311272      1
  020173  030173  311273      1
  020174  030174  311274      1
  020175  030175  311275      1
  020176  030176  311276      1
  020177  030177  311277      1
  020178  030178  311278      1
  020179  030179  311279      1
  020180  030180  311280      1
  020181  030181  311281      1
```

```
 020182  030182  311282      1
 020183  030183  311283      1
Application: Diuron: One ground appl.@9.6 lb a.i./ac (10.7 Kg/h) @99% eff, w/64%drift
   36     1     0     0
Diruon
 010748  0 2 0.00 10.7 0.99 0.064
 010749  0 2 0.00 10.7 0.99 0.063
 010750  0 2 0.00 10.7 0.99 0.064
 010751  0 2 0.00 10.7 0.99 0.064
 010752  0 2 0.00 10.7 0.99 0.064
 010753  0 2 0.00 10.7 0.99 0.064
 010754  0 2 0.00 10.7 0.99 0.064
 010755  0 2 0.00 10.7 0.99 0.064
 010756  0 2 0.00 10.7 0.99 0.064
 010757  0 2 0.00 10.7 0.99 0.064
 010758  0 2 0.00 10.7 0.99 0.064
 010759  0 2 0.00 10.7 0.99 0.064
 010760  0 2 0.00 10.7 0.99 0.064
 010761  0 2 0.00 10.7 0.99 0.064
 010762  0 2 0.00 10.7 0.99 0.064
 010763  0 2 0.00 10.7 0.99 0.064
 010764  0 2 0.00 10.7 0.99 0.064
 010765  0 2 0.00 10.7 0.99 0.064
 010766  0 2 0.00 10.7 0.99 0.064
 010767  0 2 0.00 10.7 0.99 0.064
 010768  0 2 0.00 10.7 0.99 0.064
 010769  0 2 0.00 10.7 0.99 0.064
 010770  0 2 0.00 10.7 0.99 0.064
 010771  0 2 0.00 10.7 0.99 0.064
 010772  0 2 0.00 10.7 0.99 0.064
 010773  0 2 0.00 10.7 0.99 0.064
 010774  0 2 0.00 10.7 0.99 0.064
 010775  0 2 0.00 10.7 0.99 0.064
 010776  0 2 0.00 10.7 0.99 0.064
 010777  0 2 0.00 10.7 0.99 0.064
 010778  0 2 0.00 10.7 0.99 0.064
 010779  0 2 0.00 10.7 0.99 0.064
 010780  0 2 0.00 10.7 0.99 0.064
 010781  0 2 0.00 10.7 0.99 0.064
 010782  0 2 0.00 10.7 0.99 0.064
 010783  0 2 0.00 10.7 0.99 0.064
   0.00      1    0.00
   0.00   0.000    0.50
Soil Series: Adamsville sand; Hydrogic Group C
 100.00          0  0  0                                  0  0  0  0  0  0
   0.0    0.00   00.00
     3
     1  10.000   1.440   0.086   0.000   0.000   0.000
         .0009   .0009   0.000
         0.100   0.086   0.036   0.580   14.00
     2  10.000   1.440   0.086   0.000   0.000   0.000
         .0009   .0009   0.000
```


43

```
   1.000  0.086  0.036  0.580  14.00
 3 80.000  1.580  0.030  0.000  0.000  0.000
   .0009  .0009  0.000
   5.000  0.030  0.023  0.116  14.00
 0
WATR  YEAR    10  PEST  YEAR    10  CONC  YEAR    10  1
 6
 11 -----
 1  DAY
RUNF  TSER  0  0  1.E0
```

IR-PCA RUN FOR DIURON ON CITRUS
OUTPUT FILE

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
----	----	-------	------	------	------	-------
1948	158.000	153.000	140.000	130.000	125.000	52.920
1949	101.000	97.610	86.240	82.120	74.800	31.870
1950	143.000	138.000	127.000	119.000	109.000	46.430
1951	304.000	295.000	262.000	207.000	175.000	66.420
1952	474.000	459.000	402.000	315.000	269.000	106.000
1953	203.000	196.000	175.000	159.000	148.000	64.180
1954	254.000	246.000	232.000	184.000	167.000	65.390
1955	140.000	136.000	120.000	102.000	92.510	42.070
1956	172.000	167.000	153.000	127.000	109.000	42.610
1957	396.000	385.000	338.000	304.000	274.000	102.000
1958	133.000	131.000	120.000	102.000	96.790	42.640
1959	181.000	175.000	158.000	149.000	142.000	56.390
1960	295.000	285.000	267.000	218.000	184.000	70.800
1961	96.630	93.500	82.100	73.890	66.550	34.640
1962	154.000	149.000	138.000	116.000	101.000	43.860
1963	205.000	198.000	180.000	144.000	120.000	45.910
1964	344.000	332.000	291.000	236.000	208.000	78.740
1965	170.000	164.000	147.000	126.000	116.000	57.240
1966	122.000	118.000	105.000	89.450	78.750	36.310
1967	226.000	221.000	196.000	175.000	159.000	64.070
1968	163.000	158.000	146.000	118.000	107.000	46.730
1969	210.000	203.000	188.000	158.000	145.000	56.510
1970	126.000	122.000	108.000	83.850	70.660	31.660
1971	117.000	115.000	104.000	88.730	82.850	38.460
1972	208.000	203.000	186.000	166.000	150.000	55.690
1973	137.000	133.000	122.000	103.000	92.350	41.870
1974	148.000	143.000	129.000	104.000	90.740	36.060
1975	124.000	120.000	104.000	93.360	84.230	36.300
1976	192.000	187.000	166.000	134.000	115.000	49.610
1977	121.000	117.000	103.000	96.110	91.580	40.360
1978	36.240	35.350	32.140	27.760	26.250	16.470
1979	172.000	166.000	145.000	128.000	119.000	48.840

1980	194.000	189.000	172.000	165.000	147.000	58.120
1981	328.000	317.000	285.000	246.000	210.000	76.380
1982	65.870	63.990	59.360	48.360	45.370	28.480
1983	283.000	277.000	248.000	195.000	165.000	58.770

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
.027	474.000	459.000	402.000	315.000	274.000	106.000
.054	396.000	385.000	338.000	304.000	269.000	102.000
.081	344.000	332.000	291.000	246.000	210.000	78.740
.108	328.000	317.000	285.000	236.000	208.000	76.380
.135	304.000	295.000	267.000	218.000	184.000	70.800
.162	295.000	285.000	262.000	207.000	175.000	66.420
.189	283.000	277.000	248.000	195.000	167.000	65.390
.216	254.000	246.000	232.000	184.000	165.000	64.180
.243	226.000	221.000	196.000	175.000	159.000	64.070
.270	210.000	203.000	188.000	166.000	150.000	58.770
.297	208.000	203.000	186.000	165.000	148.000	58.120
.324	205.000	198.000	180.000	159.000	147.000	57.240
.351	203.000	196.000	175.000	158.000	145.000	56.510
.378	194.000	189.000	172.000	149.000	142.000	56.390
.405	192.000	187.000	166.000	144.000	125.000	55.690
.432	181.000	175.000	158.000	134.000	120.000	52.920
.459	172.000	167.000	153.000	130.000	119.000	49.610
.486	172.000	166.000	147.000	128.000	116.000	48.840
.514	170.000	164.000	146.000	127.000	115.000	46.730
.541	163.000	158.000	145.000	126.000	109.000	46.430
.568	158.000	153.000	140.000	119.000	109.000	45.910
.595	154.000	149.000	138.000	118.000	107.000	43.860
.622	148.000	143.000	129.000	116.000	101.000	42.640
.649	143.000	138.000	127.000	104.000	96.790	42.610
.676	140.000	136.000	122.000	103.000	92.510	42.070
.703	137.000	133.000	120.000	102.000	92.350	41.870
.730	133.000	131.000	120.000	102.000	91.580	40.360
.757	126.000	122.000	108.000	96.110	90.740	38.460
.784	124.000	120.000	105.000	93.360	84.230	36.310
.811	122.000	118.000	104.000	89.450	82.850	36.300
.838	121.000	117.000	104.000	88.730	78.750	36.060
.865	117.000	115.000	103.000	83.850	74.800	34.640
.892	101.000	97.610	86.240	82.120	70.660	31.870
.919	96.630	93.500	82.100	73.890	66.550	31.660
.946	65.870	63.990	59.360	48.360	45.370	28.480
.973	36.240	35.350	32.140	27.760	26.250	16.470
1/10	332.800	321.500	286.800	239.000	208.600	77.088

MEAN OF ANNUAL VALUES = 51.967

STANDARD DEVIATION OF ANNUAL VALUES = 18.884

UPPER 90% CONFIDENCE LIMIT ON MEAN = 56.627

PRZM/EXAMS INPUT FILE FOR DIURON ON CA-GRAPES

```
***PRZM 3.1 Input Data File converted from PRZM 2.3***
***CaGrape.INP, created 22 March 1999; Stanislaus county, CA.***
***Soil Hanford, Hydrologic Group B ***
***Assume poor grass coverage under vines and overland flow***
***Pesticide is ground spray applied***
*** This is intended to use a modified metfile, incorporating irrigation ***
*** cropping curve number reduced from 78 to fit the 15% of flood irrigation ***
*** water which runs off. The 15% number comes from Terry Pritchard, ***
*** San Joachin county cooperative extension, (209) 468-2085 ***
Diuron
Hanford fine sandyloam; MLRA L-17, Stanislaus County, CA, Grapes
  0.852  0.450     0  15.00     1     3
    4
   0.34   0.15   1.00     10   5.80     1  0.500    354
    1
    1   0.25  90.00 100.00     3  86  59  82          0.00  150.0
    1     3
0101 0110 0111
0.05 0.05 0.05
.023 .023 .023
   36
 070448 300648 311048     1
 070449 300649 311049     1
 070450 300650 311050     1
 070451 300651 311051     1
 070452 300652 311052     1
 070453 300653 311053     1
 070454 300654 311054     1
 070455 300655 311055     1
 070456 300656 311056     1
 070457 300657 311057     1
 070458 300658 311058     1
 070459 300659 311059     1
 070460 300660 311060     1
 070461 300661 311061     1
 070462 300662 311062     1
 070463 300663 311063     1
 070464 300664 311064     1
 070465 300665 311065     1
 070466 300666 311066     1
 070467 300667 311067     1
 070468 300668 311068     1
 070469 300669 311069     1
 070470 300670 311070     1
```

070471	300671	311071	1
070472	300672	311072	1
070473	300673	311073	1
070474	300674	311074	1
070475	300675	311075	1
070476	300676	311076	1
070477	300677	311077	1
070478	300678	311078	1
070479	300679	311079	1
070480	300680	311080	1
070481	300681	311081	1
070482	300682	311082	1
070483	300683	311083	1

Application Schedule: 1 ground spray app, 9.6 lb a.i./acre, 99% effic. w/1% drift

36 1 0 0

Diuron Kd:14 (SANDY LOAM); ASM: T1/2 = 372 days

```
050148 0 2 0.0 10.80 0.99 0.01
050149 0 2 0.0 10.80 0.99 0.01
050150 0 2 0.0 10.80 0.99 0.01
050151 0 2 0.0 10.80 0.99 0.01
050152 0 2 0.0 10.80 0.99 0.01
050153 0 2 0.0 10.80 0.99 0.01
050154 0 2 0.0 10.80 0.99 0.01
050155 0 2 0.0 10.80 0.99 0.01
050156 0 2 0.0 10.80 0.99 0.01
050157 0 2 0.0 10.80 0.99 0.01
050158 0 2 0.0 10.80 0.99 0.01
050159 0 2 0.0 10.80 0.99 0.01
050160 0 2 0.0 10.80 0.99 0.01
050161 0 2 0.0 10.80 0.99 0.01
050162 0 2 0.0 10.80 0.99 0.01
050163 0 2 0.0 10.80 0.99 0.01
050164 0 2 0.0 10.80 0.99 0.01
050165 0 2 0.0 10.80 0.99 0.01
050166 0 2 0.0 10.80 0.99 0.01
050167 0 2 0.0 10.80 0.99 0.01
050168 0 2 0.0 10.80 0.99 0.01
050169 0 2 0.0 10.80 0.99 0.01
050170 0 2 0.0 10.80 0.99 0.01
050171 0 2 0.0 10.80 0.99 0.01
050172 0 2 0.0 10.80 0.99 0.01
050173 0 2 0.0 10.80 0.99 0.01
050174 0 2 0.0 10.80 0.99 0.01
050175 0 2 0.0 10.80 0.99 0.01
050176 0 2 0.0 10.80 0.99 0.01
050177 0 2 0.0 10.80 0.99 0.01
050178 0 2 0.0 10.80 0.99 0.01
050179 0 2 0.0 10.80 0.99 0.01
050180 0 2 0.0 10.80 0.99 0.01
050181 0 2 0.0 10.80 0.99 0.01
050182 0 2 0.0 10.80 0.99 0.01
050183 0 2 0.0 10.80 0.99 0.01
```

```
  0.0     3    0.0
  0.0
Hanford fine sandy Loam; Hydrologic Group B;
 150.00        0  0  0  0  0  0  0  0  0
  0.0    0.0    0.5
   3
   1  30.00  1.500  0.222  0.000  0.000  0.00
      0.002  0.002  0.000
        0.1  0.125  0.050  0.750   14.0
   2  60.00  1.500  0.210  0.000  0.000  0.00
      0.002  0.002  0.000
        1.0  0.120  0.050  0.200   14.0
   3  60.00  1.500  0.200  0.000  0.000  0.00
      0.002  0.002  0.000
        5.0  0.100  0.050  0.125   14.0
   0
      YEAR    10        YEAR    10        YEAR    10  1
   1
   1 -----
   7  YEAR
  PRCP   TCUM  0  0
  RUNF   TCUM  0  0
  INFL   TCUM  1  1
  ESLS   TCUM  0  0  1.0E3
  RFLX   TCUM  0  0  1.0E5
  EFLX   TCUM  0  0  1.0E5
  RZFX   TCUM  0  0  1.0E5
```

PRZM/EXAMS OUTPUT FILE FOR DIURON ON CA-GRAPES

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
----	----	-------	------	------	------	------
1948	5.398	5.320	5.032	4.560	4.310	3.192
1949	7.804	7.724	7.425	6.923	6.647	5.193
1950	9.402	9.320	9.013	8.493	8.200	6.521
1951	10.460	10.380	10.070	9.534	9.230	7.402
1952	12.190	12.110	11.800	11.300	11.030	9.070
1953	13.180	13.090	12.750	12.160	11.810	9.581
1954	19.280	19.110	18.490	17.420	16.810	13.410
1955	17.680	17.570	17.170	16.710	16.390	13.550
1956	16.060	15.970	15.630	15.030	14.670	12.050
1957	14.870	14.790	14.450	13.870	13.520	11.080
1958	15.970	15.880	15.540	14.970	14.560	12.580
1959	15.700	15.610	15.270	14.680	14.320	11.750
1960	19.070	18.910	18.320	16.960	14.350	12.320
1961	21.430	21.300	20.800	19.930	19.410	15.900
1962	39.790	39.430	38.050	35.680	34.510	26.600

1963	35.440	35.230	34.440	33.080	32.240	26.750
1964	26.950	26.850	26.460	25.730	25.250	21.100
1965	22.090	21.990	21.630	20.960	20.660	17.740
1966	23.070	22.940	22.460	21.580	21.020	17.680
1967	20.480	20.370	20.080	19.620	19.210	15.900
1968	18.070	17.980	17.620	16.990	16.610	13.700
1969	17.580	17.520	17.180	16.540	16.110	13.790
1970	18.860	18.760	18.350	17.590	17.120	14.400
1971	17.440	17.340	16.980	16.340	15.950	13.120
1972	15.720	15.630	15.300	14.700	14.340	11.810
1973	22.440	22.250	21.550	20.340	19.800	15.960
1974	22.700	22.550	22.010	21.000	20.360	17.090
1975	21.500	21.400	21.020	20.520	20.270	16.910
1976	18.740	18.650	18.300	18.060	17.780	14.800
1977	17.950	17.860	17.520	16.860	16.400	14.400
1978	94.320	93.150	88.790	81.590	77.600	55.850
1979	51.980	51.860	51.590	50.720	49.980	42.290
1980	39.770	39.650	39.210	38.500	38.080	32.230
1981	31.530	31.430	31.010	30.560	30.160	25.390
1982	25.530	25.430	25.050	24.330	24.030	20.580
1983	28.440	28.270	27.600	26.660	26.070	21.590

SORTED FOR PLOTTING

PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	94.320	93.150	88.790	81.590	77.600	55.850
0.054	51.980	51.860	51.590	50.720	49.980	42.290
0.081	39.790	39.650	39.210	38.500	38.080	32.230
0.108	39.770	39.430	38.050	35.680	34.510	26.750
0.135	35.440	35.230	34.440	33.080	32.240	26.600
0.162	31.530	31.430	31.010	30.560	30.160	25.390
0.189	28.440	28.270	27.600	26.660	26.070	21.590
0.216	26.950	26.850	26.460	25.730	25.250	21.100
0.243	25.530	25.430	25.050	24.330	24.030	20.580
0.270	23.070	22.940	22.460	21.580	21.020	17.740
0.297	22.700	22.550	22.010	21.000	20.660	17.680
0.324	22.440	22.250	21.630	20.960	20.360	17.090
0.351	22.090	21.990	21.550	20.520	20.270	16.910
0.378	21.500	21.400	21.020	20.340	19.800	15.960
0.405	21.430	21.300	20.800	19.930	19.410	15.900
0.432	20.480	20.370	20.080	19.620	19.210	15.900
0.459	19.280	19.110	18.490	18.060	17.780	14.800
0.486	19.070	18.910	18.350	17.590	17.120	14.400
0.514	18.860	18.760	18.320	17.420	16.810	14.400
0.541	18.740	18.650	18.300	16.990	16.610	13.790
0.568	18.070	17.980	17.620	16.960	16.400	13.700
0.595	17.950	17.860	17.520	16.860	16.390	13.550
0.622	17.680	17.570	17.180	16.710	16.110	13.410
0.649	17.580	17.520	17.170	16.540	15.950	13.120

0.676	17.440	17.340	16.980	16.340	14.670	12.580
0.703	16.060	15.970	15.630	15.030	14.560	12.320
0.730	15.970	15.880	15.540	14.970	14.350	12.050
0.757	15.720	15.630	15.300	14.700	14.340	11.810
0.784	15.700	15.610	15.270	14.680	14.320	11.750
0.811	14.870	14.790	14.450	13.870	13.520	11.080
0.838	13.180	13.090	12.750	12.160	11.810	9.581
0.865	12.190	12.110	11.800	11.300	11.030	9.070
0.892	10.460	10.380	10.070	9.534	9.230	7.402
0.919	9.402	9.320	9.013	8.493	8.200	6.521
0.946	7.804	7.724	7.425	6.923	6.647	5.193
0.973	5.398	5.320	5.032	4.560	4.310	3.192
1/10	39.776	39.496	38.398	36.526	35.581	28.394

MEAN OF ANNUAL VALUES = 17.036

STANDARD DEVIATION OF ANNUAL VALUES = 10.111

UPPER 90% CONFIDENCE LIMIT ON MEAN = 19.531

PRZM/EXAMS INPUT FILE FOR DIURON ON FL-CITRUS

```
*** PRZM 3.12 Input Data File ***
*** Modeler: I. Abdel-Saheb ***
*** Assume bare soil underneath the trees for heating ***
*** MET156A.MET ***
*** 2 air blast apps @ 0.99 lb a.i/a, 95% appl eff, 0.05% spray drift ***
MBC from benomyl
Adamsville Sand; MLRA U-156A, Osceola County, FL
  0.770  0.150     0  25.00     1     1
    4
  0.10   0.13   1.00  10.00          3  1.00  345.0
    1
    1  0.10 100.00  80.00     3 91  74  83           0.0    600    0.00
    1    3
0101 21 9 2209
0.10 0.10 0.10
.023 .023 .023
   36
 020148 030148 310148      1
 020149 030149 310149      1
 020150 030150 310150      1
 020151 030151 310151      1
 020152 030152 310152      1
 020153 030153 310153      1
 020154 030154 310154      1
 020155 030155 310155      1
 020156 030156 310156      1
```


52

020157	030157	310157	1
020158	030158	310158	1
020159	030159	310159	1
020160	030160	310160	1
020161	030161	310161	1
020162	030162	310162	1
020163	030163	310163	1
020164	030164	310164	1
020165	030165	310165	1
020166	030166	310166	1
020167	030167	310167	1
020168	030168	310168	1
020169	030169	310169	1
020170	030170	310170	1
020171	030171	310171	1
020172	030172	310172	1
020173	030173	310173	1
020174	030174	310174	1
020175	030175	310175	1
020176	030176	310176	1
020177	030177	310177	1
020178	030178	310178	1
020179	030179	310179	1
020180	030180	310180	1
020181	030181	310181	1
020182	030182	310182	1
020183	030183	310183	1

Application schedule: One ground appl. @ 6.4 lb a.i/a, 99% appl eff, 0.01 % spray drift

36 1 0

Diuron

010748	0	2	0.00	7.20	0.99	0.010
010749	0	2	0.00	7.20	0.99	0.010
010750	0	2	0.00	7.20	0.99	0.010
010751	0	2	0.00	7.20	0.99	0.010
010752	0	2	0.00	7.20	0.99	0.010
010753	0	2	0.00	7.20	0.99	0.010
010754	0	2	0.00	7.20	0.99	0.010
010755	0	2	0.00	7.20	0.99	0.010
010756	0	2	0.00	7.20	0.99	0.010
010757	0	2	0.00	7.20	0.99	0.010
010758	0	2	0.00	7.20	0.99	0.010
010759	0	2	0.00	7.20	0.99	0.010
010760	0	2	0.00	7.20	0.99	0.010
010761	0	2	0.00	7.20	0.99	0.010
010762	0	2	0.00	7.20	0.99	0.010
010763	0	2	0.00	7.20	0.99	0.010
010764	0	2	0.00	7.20	0.99	0.010
010765	0	2	0.00	7.20	0.99	0.010
010766	0	2	0.00	7.20	0.99	0.010
010767	0	2	0.00	7.20	0.99	0.010
010768	0	2	0.00	7.20	0.99	0.010
010769	0	2	0.00	7.20	0.99	0.010

```
010770  0 2 0.00 7.20 0.99 0.010
010771  0 2 0.00 7.20 0.99 0.010
010772  0 2 0.00 7.20 0.99 0.010
010773  0 2 0.00 7.20 0.99 0.010
010774  0 2 0.00 7.20 0.99 0.010
010775  0 2 0.00 7.20 0.99 0.010
010776  0 2 0.00 7.20 0.99 0.010
010777  0 2 0.00 7.20 0.99 0.010
010778  0 2 0.00 7.20 0.99 0.010
010779  0 2 0.00 7.20 0.99 0.010
010780  0 2 0.00 7.20 0.99 0.010
010781  0 2 0.00 7.20 0.99 0.010
010782  0 2 0.00 7.20 0.99 0.010
010783  0 2 0.00 7.20 0.99 0.010
   0.      1
  0.0  0.072    0.5
Adamsville Sand; Hydrologic Group C
 100.00        0  0  0  0  0  0  0  0  0
  0.0    0.0   0.00
    3
    1   10.00   1.440   0.086   0.000   0.000   0.00
        .002    .002   0.000
         0.1   0.086   0.036   0.580   14.00
    2   10.00   1.440   0.086   0.000   0.000   0.00
        .002    .002   0.000
         1.0   0.086   0.036   0.580   14.00   0.00
    3   80.00   1.580   0.030   0.000   0.000
        .002    .002   0.000
         5.0   0.030   0.023   0.116   14.00
          0
  WATR   YEAR    10   PEST   YEAR    10   CONC   YEAR    10  1
    6
    11 -----
    1   DAY
  RUNF   TSER  0  0  1.E0
```

PRZM/EXAMS OUT FILE FOR DIURON ON FL-CITRUS

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
----	----	--------	-------	-------	-------	-------
1948	41.250	40.840	39.670	38.640	37.560	17.810
1949	41.700	41.370	40.900	40.150	39.600	32.960
1950	63.180	62.850	61.030	59.980	59.240	45.300
1951	104.000	103.000	99.260	93.290	89.570	65.520
1952	164.000	162.000	155.000	145.000	140.000	101.000
1953	135.000	134.000	130.000	128.000	126.000	115.000
1954	145.000	144.000	141.000	135.000	132.000	113.000
1955	119.000	118.000	115.000	112.000	111.000	105.000

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1956	103.000	102.000	100.000	97.490	95.600	89.990
1957	157.000	156.000	150.000	148.000	144.000	108.000
1958	127.000	126.000	124.000	120.000	118.000	111.000
1959	123.000	122.000	119.000	118.000	116.000	103.000
1960	129.000	128.000	127.000	122.000	119.000	101.000
1961	108.000	108.000	107.000	106.000	105.000	94.910
1962	96.570	95.860	94.310	91.250	89.260	82.030
1963	92.100	91.410	89.410	86.390	84.340	75.350
1964	122.000	121.000	116.000	111.000	109.000	83.840
1965	103.000	102.000	100.000	98.080	96.380	91.350
1966	92.950	92.330	90.070	87.540	86.390	82.090
1967	114.000	113.000	110.000	106.000	104.000	84.390
1968	105.000	105.000	102.000	98.400	96.480	87.980
1969	119.000	118.000	115.000	110.000	108.000	90.770
1970	92.750	92.620	92.090	90.860	89.830	83.490
1971	83.970	83.670	82.190	79.930	78.990	74.300
1972	100.000	99.460	96.810	95.270	94.030	76.820
1973	90.170	89.640	88.130	85.390	83.740	78.070
1974	86.120	85.460	83.260	79.970	77.870	71.390
1975	80.250	79.660	77.350	75.820	74.370	67.440
1976	93.180	92.430	89.710	85.900	83.650	69.710
1977	87.530	87.000	84.980	84.010	83.200	74.110
1978	73.590	73.490	73.050	72.050	71.220	63.370
1979	79.980	79.250	76.470	73.670	73.020	60.290
1980	94.500	93.830	91.730	89.700	87.820	71.040
1981	119.000	118.000	115.000	112.000	109.000	83.030
1982	94.780	94.620	93.990	92.570	91.450	81.890
1983	114.000	113.000	109.000	103.000	99.340	78.620

SORTED FOR PLOTTING
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PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
0.027	164.000	162.000	155.000	148.000	144.000	115.000
0.054	157.000	156.000	150.000	145.000	140.000	113.000
0.081	145.000	144.000	141.000	135.000	132.000	111.000
0.108	135.000	134.000	130.000	128.000	126.000	108.000
0.135	129.000	128.000	127.000	122.000	119.000	105.000
0.162	127.000	126.000	124.000	120.000	118.000	103.000
0.189	123.000	122.000	119.000	118.000	116.000	101.000
0.216	122.000	121.000	116.000	112.000	111.000	101.000
0.243	119.000	118.000	115.000	112.000	109.000	94.910
0.270	119.000	118.000	115.000	111.000	109.000	91.350
0.297	119.000	118.000	115.000	110.000	108.000	90.770
0.324	114.000	113.000	110.000	106.000	105.000	89.990
0.351	114.000	113.000	109.000	106.000	104.000	87.980
0.378	108.000	108.000	107.000	103.000	99.340	84.390
0.405	105.000	105.000	102.000	98.400	96.480	83.840
0.432	104.000	103.000	100.000	98.080	96.380	83.490
0.459	103.000	102.000	100.000	97.490	95.600	83.030

0.486	103.000	102.000	99.260	95.270	94.030	82.090
0.514	100.000	99.460	96.810	93.290	91.450	82.030
0.541	96.570	95.860	94.310	92.570	89.830	81.890
0.568	94.780	94.620	93.990	91.250	89.570	78.620
0.595	94.500	93.830	92.090	90.860	89.260	78.070
0.622	93.180	92.620	91.730	89.700	87.820	76.820
0.649	92.950	92.430	90.070	87.540	86.390	75.350
0.676	92.750	92.330	89.710	86.390	84.340	74.300
0.703	92.100	91.410	89.410	85.900	83.740	74.110
0.730	90.170	89.640	88.130	85.390	83.650	71.390
0.757	87.530	87.000	84.980	84.010	83.200	71.040
0.784	86.120	85.460	83.260	79.970	78.990	69.710
0.811	83.970	83.670	82.190	79.930	77.870	67.440
0.838	80.250	79.660	77.350	75.820	74.370	65.520
0.865	79.980	79.250	76.470	73.670	73.020	63.370
0.892	73.590	73.490	73.050	72.050	71.220	60.290
0.919	63.180	62.850	61.030	59.980	59.240	45.300
0.946	41.700	41.370	40.900	40.150	39.600	32.960
0.973	41.250	40.840	39.670	38.640	37.560	17.810
1/10	138.000	137.000	133.300	130.100	127.800	108.900

MEAN OF ANNUAL VALUES = 80.968

STANDARD DEVIATION OF ANNUAL VALUES = 21.004

UPPER 90% CONFIDENCE LIMIT ON MEAN = 86.152

PRZM/EXAMS INPUT FILE FOR DIURON ON NY-APPLES

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*** PRZM 3.1 Input Data File converted from PRZM 2.3 ***
*** NYAPPLE.INP, January 15, 1998 ***
*** Mannings N value for sparse grass under trees ***
*** Original file used Sharky Clay loam; changed to Cabot silt loam; 3% of MLRA ***
Diuron
Columbia Co, New York; MLRA 144B Apples, Crab Apples, Quince
  0.850  0.450     2  20.000     1     3
   9.7   10.4   11.8   13.1   14.3   14.8
  14.5   14.0   12.3   11.0    9.8    9.1
   4
  0.01   0.01    1.0   10.0    3.8     3  12.00  354.0
   1
   1   0.30   60.0  90.000     3  94  84  89           0.00   500.0
   3    1
0103 0111 0101
0.74 0.01 0.01
.015 .015 .015
   36
 010448 150548 151248     1
 010449 150549 151249     1
 010450 150550 151250     1
 010451 150551 151251     1
```

010452	150552	151252	1
010453	150553	151253	1
010454	150554	151254	1
010455	150555	151255	1
010456	150556	151256	1
010457	150557	151257	1
010458	150558	151258	1
010459	150559	151259	1
010460	150560	151260	1
010461	150561	151261	1
010462	150562	151262	1
010463	150563	151263	1
010464	150564	151264	1
010465	150565	151265	1
010466	150566	151266	1
010467	150567	151267	1
010468	150568	151268	1
010469	150569	151269	1
010470	150570	151270	1
010471	150571	151271	1
010472	150572	151272	1
010473	150573	151273	1
010474	150574	151274	1
010475	150575	151275	1
010476	150576	151276	1
010477	150577	151277	1
010478	150578	151278	1
010479	150579	151279	1
010480	150580	151280	1
010481	150581	151281	1
010482	150582	151282	1
010483	150583	151283	1

Application Schedule: One ground appl. @ 4.0 lb/acre, 99% eff w/1% drift

36 1 0

Diuron Kd: 7.9; AeSM: T1/2 = 372 d

200448	0	2	0.00	4.50	0.99	0.01
200449	0	2	0.00	4.50	0.99	0.01
200450	0	2	0.00	4.50	0.99	0.01
200451	0	2	0.00	4.50	0.99	0.01
200452	0	2	0.00	4.50	0.99	0.01
200453	0	2	0.00	4.50	0.99	0.01
200454	0	2	0.00	4.50	0.99	0.01
200455	0	2	0.00	4.50	0.99	0.01
200456	0	2	0.00	4.50	0.99	0.01
200457	0	2	0.00	4.50	0.99	0.01
200458	0	2	0.00	4.50	0.99	0.01
200459	0	2	0.00	4.50	0.99	0.01
200460	0	2	0.00	4.50	0.99	0.01
200461	0	2	0.00	4.50	0.99	0.01
200462	0	2	0.00	4.50	0.99	0.01
200463	0	2	0.00	4.50	0.99	0.01
200464	0	2	0.00	4.50	0.99	0.01

55

```
200465  0 2 0.00  4.50 0.99 0.01
200466  0 2 0.00  4.50 0.99 0.01
200467  0 2 0.00  4.50 0.99 0.01
200468  0 2 0.00  4.50 0.99 0.01
200469  0 2 0.00  4.50 0.99 0.01
200470  0 2 0.00  4.50 0.99 0.01
200471  0 2 0.00  4.50 0.99 0.01
200472  0 2 0.00  4.50 0.99 0.01
200473  0 2 0.00  4.50 0.99 0.01
200474  0 2 0.00  4.50 0.99 0.01
200475  0 2 0.00  4.50 0.99 0.01
200476  0 2 0.00  4.50 0.99 0.01
200477  0 2 0.00  4.50 0.99 0.01
200478  0 2 0.00  4.50 0.99 0.01
200479  0 2 0.00  4.50 0.99 0.01
200480  0 2 0.00  4.50 0.99 0.01
200481  0 2 0.00  4.50 0.99 0.01
200482  0 2 0.00  4.50 0.99 0.01
200483  0 2 0.00  4.50 0.99 0.01
   0.0      1    0.0
   0.0    0.0    0.5
Cabot Silt loam; Hydrologic Group D;
  100.0    0.0  0  0  0  0  0  0  0  0
  0.00   0.00   0.00
    3
    1   20.0   1.10  0.288    0.0    0.0
      0.002  0.002  0.000
        0.2  0.288  0.108  6.961   7.90
    2   16.0   1.70  0.197    0.0    0.0
      0.002  0.002  0.000
        2.0  0.197  0.037  0.290   7.90
    3   64.0   1.90  0.151    0.0    0.0
      0.002  0.0092  0.000
        2.0  0.151  0.041  0.174   7.90
    0
                    YEAR      5        YEAR      5        YEAR      5  1
    6
    1 -----
    6  YEAR
  PRCP   TCUM  0  0
  RUNF   TCUM  0  0
  RFLX   TCUM  0  0  1.0E5
  EFLX   TCUM  0  0  1.0E5
  ESLS   TCUM  0  0  1.0E3
  RZFX   TCUM  0  0  1.0E5
```

PRZM/EXAMS OUT FILE FOR DIURON ON NY APPLES

WATER COLUMN DISSOLVED CONCENTRATION (PPB)

56

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
----	----	-------	------	------	------	------
1948	20.130	19.830	18.960	17.410	16.610	9.222
1949	16.990	16.870	16.470	16.050	15.890	14.100
1950	28.370	28.100	27.080	26.250	25.370	20.060
1951	25.140	24.970	24.330	23.800	23.240	20.870
1952	40.610	40.260	38.960	37.750	36.460	27.980
1953	35.600	35.410	34.780	33.830	33.240	29.980
1954	42.040	41.710	40.470	38.210	37.360	30.960
1955	34.660	34.410	33.870	32.750	32.310	29.720
1956	36.600	36.420	35.780	34.630	33.650	29.940
1957	38.780	38.520	37.820	36.190	36.040	31.240
1958	38.580	38.340	37.400	36.590	35.800	31.750
1959	44.910	44.520	43.030	40.660	39.400	33.030
1960	64.810	64.160	62.230	58.040	55.570	41.840
1961	72.190	71.750	70.450	68.330	67.250	53.580
1962	50.340	50.280	50.050	49.450	48.920	46.260
1963	49.310	49.030	48.280	47.250	46.580	41.810
1964	58.920	58.490	56.830	54.900	54.290	43.970
1965	41.510	41.460	41.310	40.820	40.380	38.450
1966	42.770	42.490	41.430	39.340	38.580	34.600
1967	48.710	48.330	46.940	44.650	43.280	35.700
1968	44.040	43.740	43.050	41.700	40.830	35.150
1969	35.890	35.670	34.830	33.510	32.830	30.710
1970	37.760	37.540	37.040	36.360	35.990	31.250
1971	38.630	38.380	37.430	35.760	35.560	31.660
1972	47.170	46.900	45.610	42.990	41.370	34.660
1973	33.020	32.980	32.820	32.410	32.060	29.380
1974	30.260	30.090	29.420	28.290	28.030	25.250
1975	39.650	39.300	38.110	37.170	36.750	29.450
1976	39.170	38.870	37.800	36.460	35.270	30.900
1977	47.090	46.730	45.380	42.960	41.520	34.310
1978	33.640	33.450	32.600	31.450	31.100	30.080
1979	32.720	32.560	31.830	30.270	29.240	27.540
1980	45.090	44.690	43.710	41.170	39.430	31.470
1981	38.610	38.410	37.660	36.630	36.210	32.130
1982	40.110	39.820	38.660	36.740	35.760	30.630
1983	50.680	50.250	49.290	46.800	45.450	35.840

SORTED FOR PLOTTING
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PROB	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
----	----	-------	------	------	------	------
0.027	72.190	71.750	70.450	68.330	67.250	53.580
0.054	64.810	64.160	62.230	58.040	55.570	46.260
0.081	58.920	58.490	56.830	54.900	54.290	43.970
0.108	50.680	50.280	50.050	49.450	48.920	41.840
0.135	50.340	50.250	49.290	47.250	46.580	41.810
0.162	49.310	49.030	48.280	46.800	45.450	38.450
0.189	48.710	48.330	46.940	44.650	43.280	35.840

0.216	47.170	46.900	45.610	42.990	41.520	35.700
0.243	47.090	46.730	45.380	42.960	41.370	35.150
0.270	45.090	44.690	43.710	41.700	40.830	34.660
0.297	44.910	44.520	43.050	41.170	40.380	34.600
0.324	44.040	43.740	43.030	40.820	39.430	34.310
0.351	42.770	42.490	41.430	40.660	39.400	33.030
0.378	42.040	41.710	41.310	39.340	38.580	32.130
0.405	41.510	41.460	40.470	38.210	37.360	31.750
0.432	40.610	40.260	38.960	37.750	36.750	31.660
0.459	40.110	39.820	38.660	37.170	36.460	31.470
0.486	39.650	39.300	38.110	36.740	36.210	31.250
0.514	39.170	38.870	37.820	36.630	36.040	31.240
0.541	38.780	38.520	37.800	36.590	35.990	30.960
0.568	38.630	38.410	37.660	36.460	35.800	30.900
0.595	38.610	38.380	37.430	36.360	35.760	30.710
0.622	38.580	38.340	37.400	36.190	35.560	30.630
0.649	37.760	37.540	37.040	35.760	35.270	30.080
0.676	36.600	36.420	35.780	34.630	33.650	29.980
0.703	35.890	35.670	34.830	33.830	33.240	29.940
0.730	35.600	35.410	34.780	33.510	32.830	29.720
0.757	34.660	34.410	33.870	32.750	32.310	29.450
0.784	33.640	33.450	32.820	32.410	32.060	29.380
0.811	33.020	32.980	32.600	31.450	31.100	27.980
0.838	32.720	32.560	31.830	30.270	29.240	27.540
0.865	30.260	30.090	29.420	28.290	28.030	25.250
0.892	28.370	28.100	27.080	26.250	25.370	20.870
0.919	25.140	24.970	24.330	23.800	23.240	20.060
0.946	20.130	19.830	18.960	17.410	16.610	14.100
0.973	16.990	16.870	16.470	16.050	15.890	9.222
1/10	53.152	52.743	52.084	51.085	50.531	42.479

MEAN OF ANNUAL VALUES = 31.819

STANDARD DEVIATION OF ANNUAL VALUES = 8.159

UPPER 90% CONFIDENCE LIMIT ON MEAN = 33.832

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APPENDIX 3

ECOLOGICAL EFFECTS CHARACTERIZATION

TERRESTRIAL RISK ASSESSMENT

I. Toxicity to Terrestrial Animals

i. Birds acute and subacute

Diuron is practically non-toxic to slightly toxic to birds in terms of acute toxicity (LD_{50} range of 900->2000 mg/kg) and subacute toxicity (LC_{50} range of 1730-5000 ppm.. Chronic avian reproduction study was not submitted by the registrant. However, avian chronic study is required because of diuron's persistency, especially there is some concern regarding the endocrine disruption effects of this compound. (Table E1, E2)

Table E1. Avian Acute Oral Toxicity

Species	%ai	LD50 (mg/kg)	Toxicity Category	MRID No. Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	92.8	940	Slightly toxic	50150170,Wildlife International, 1985	Core
Mallard duck *(Anas platyrhynchos)*	95	>2000	Practical nontoxic	00160000, Hudson, R.H. et al,1970	Core

[1] Core (study satisfies guideline). Supplemental (study is scientifically sound, but does not satisfy guideline)

Table E2. Avian Subacute Dietary Toxicity

Species	% ai	5-Day LC50 (ppm)[1]	Toxicity Category	MRID No. Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	>95	>5000	Practically non-toxic	00022923,Hill E. .R. et al. 1975	Core
Mallard duck *(Anas platyrhynchos)*	>95	1730	Slightly toxic	00022923,Hill ER et al. 1975	Core
Red-neck Pheasant	>95	>5000	Practically non-toxic	00022923,Hill ER et al. 1975	Core
Japanese quail	>95	>5000	Practically non-toxic	00022923,Hill ER et al. 1975	Supplemental

[1] Test organisms observed an additional three days while on untreated feed.

II. Exposure and Risk to Nontarget Terrestrial Animals

For pesticides applied as a nongranular product (*e.g.*, liquid, dust), the estimated environmental concentrations (EECs) on food items following product application are compared to LC50 values to assess risk. The predicted 0-day maximum and mean residues of a pesticide that may be expected to occur on selected avian or mammalian food items immediately following a direct single application at 1 lb ai/A are tabulated below.

Table. E3. Estimated Environmental Concentrations on Avian and Mammalian Food Items (ppm) Following a Single Application at 1 lb ai/A)

Food Items	EEC (ppm) Predicted Maximum Residue[1]	EEC (ppm) Predicted Mean Residue[1]
Short grass	240	85
Tall grass	110	36
Broadleaf/forage plants and small insects	135	45
Fruits, pods, seeds, and large insects	15	7

[1] Predicted maximum and mean residues are for a 1 lb ai/a application rate and are based on Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994).

iii. Mammals, Acute and Chronic

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. These toxicity values are reported below.

Table E4. Table Mammalian Toxicity

Species/ Study Duration	% ai	Test Type	Toxicity Value	Affected Endpoints	MRID No.
laboratory rat or mouse *(Rattus norvegicus or Mus musculus)*	*98*	*Acute oral LD_{50}*	*LD_{50}(M/F)=5000 /10000 mg/kg*	*mortality*	*00146145*
Laboratory rat or mouse *(Rattus norvegicus or Mus musculus)*	97.1	Reproduction study 2- generation	NOEL/LOEL=250/ 1750 ppm	pup body weight	41957301

The results indicate that diuron is in Toxicity Category III to small mammals on an acute oral basis.

iv. Insects

A honey bee acute contact study using the TGAI is required for diuron because its use on blooming crops such as cotton and tomato will result in honey bee exposure. Results of this test are tabulated below.

Table E15. Non-target Insect Acute Contact Toxicity

Species	% ai	LD50 (µg/bee)	Toxicity Category	MRID No. Author /Year	Study Classification
Honey bee *(Apis mellifera)*	Technical	145	Relative non-toxic	00036935 Atkins & Anderson /1975	core

The results indicate that diuron is relative non-toxic to bees on an acute contact basis. The guideline (141-1) is fulfilled (MRID 00036935).

A honey bee toxicity of residues on foliage study using the typical end-use product is not required for diuron because its LD50 is greater than 0.11 *ug*/bee.

AQUATIC RISK ASSESSMENT

i. Toxicity to Freshwater Animals

Freshwater fish and invertebrates' toxicities are listed below (Table E14). Diuron is moderately to highly toxic to freshwater fish with LC_{50} values range 0.71 - 14.2 mg/l. . Cutthroat trout was the most sensitive species tested (LC_{50} = 0.71 mg/l). Studies conducted with formulated products (28 % to 80 % active ingredient) suggested that formulated end product is less toxic to freshwater fish than technical end product. Freshwater invertebrate toxicity testing showed that diuron is moderately to highly toxic with LC_{50} values range 0.16 to 8.4 ppm. The amphipod scud is the most sensitive freshwater invertebrate tested (LC_{50} = 0.16 ppm).

Chronic testing of freshwater fish establishes NOEC and LOEC (affected endpoint = reduced average number of scurvier) of 26.4 and 61.8 µg/l , respectively. However, no effect is observed for daphnid up to 0.2 mg/l (the highest concentration tested).

Table E16. Freshwater organisms Acute/chronic Toxicity

Species/ (Flow-through or Static)	% ai	Acute LC_{50}/ EC_5 (ppm)	Chronic LOEC/ NOEC (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
Rainbow trout *(Oncorhynchus mykiss)* static	95	1. 95		Moderately toxic	STODIU04 EPA /1976	Core
Rainbow trout *(Oncorhynchus mykiss)* static	80	16		Slightly toxic	40094602 Johnson &Finley/1980	Supplemental
Bluegill sunfish *(Lepomis macrochirus*	95	3. 2		Moderately toxic	STODIV03 EPA /1976	Core
Bluegill sunfish *(Lepomis macrochirus*	80	>300		Practically non-toxic	42046001 Baer, K.N. /1992	Core
Bluegill sunfish *(Lepomis macrochirus*	95	2. 8		Moderately toxic	40098001 Mayer & Ellersech/1986	Core
Fathead minnow *(Pimephales promelas)*	98. 6	14. 2		Slightly toxic	00141636 Brook & Kent/1975	Supplemental
Cutthroat trout *(Onceryncbus clarki)*	95	1. 4		Moderately toxic	40094602 Johnson &Finley /1980	Core
Cutthroat trout *(Onceryncbus clarki)*	95	0. 71		Highly toxic	40098001 Mayer & Ellersech/1986	Core
Lake trout *(Salvelinus namaycush)*	95	2. 7		Moderately toxic	40094602 Johnson &Finley /1980	Core
Lake trout *(Onceryncbus clarki)*	95	1. 2		Moderately toxic	40098001 Mayer & Ellersech/1986	Core
Cohe salmon (Oncorrhynchus kisutch)	95	<2.4		Moderately toxic	40098001/1986 Mayer & Ellersech	Core
Rainbow trout *(Oncorhynchus mykiss)* static	28	23. 8		Slightly toxic	STODIU04 EPA 1976	Core
Bluegill sunfish *(Lepomis macrochirus*	28	84. 0		Slightly toxic	STODIU04 EPA/1976	Core
..Fathead minnow *(Pimephales promelas)*	98.6	0	61.8/ 26.4	Reduction of adult survival	00141636 EPA/1975 (Duluth lab.)	Core
Waterflea *(Daphnia magna)*	80	8 .4		Moderately toxic	42046003 Baer,K.N.1991	Core
Waterflea *(Daphnia duplex)*	95	1.4		Moderately toxic	40094602 Johnson and Finley/1980	Core
Simocephalus sp.	95	2. 0		Moderately toxic	40094602 Johnson and Finley/1980	Core
Scud *(Gammarus fasciatus)*	95	0.16		Highly toxic	40094602 Johnson and Finley/1980	Core
Stonefly *(Pteronarcys sp.)*	95	1. 2		Moderately toxic	40094602 Johnson and Finley/1980	Core
Waterflea *(Daphnia magna)*	98.2		>0. 2/0.2	No effect	STODIV05 EPA/1979	Supplemental

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ii. Toxicity to Estuarine and Marine Animals

Estuarine and marine fish and invertebrates' toxicities are listed below (Table E15). Diuron is moderately toxic to both estuarine and marine fish and invertebrates. Their LC_{50} values range 6.3 to 6.7 mg/l and 1 to 4.9 mg/l for estuarine and marine fish and invertebrate, respectively. Chronically, growth effects were observed for fish at 0.44 mg/l, and growth and reproduction reduced effects were noticed at 0.27 mg/l for mysids.

Table E17. Estuarine/Marine Organisms Acute Toxicity

Species/(Static or Flow-through)	% ai	Acute LC_{50} /LC_{50}	Chronic LOEC/NOEC	Toxicity Category	MRID No. Author/Year	Study Classification
Sheepshead minnow *(Cyprinodon variegatus)*	99	6. 7		Moderately toxic	41418805/Drottar, K.R./1986	Core
Striped mullet *(Mugil cephalus)*	95	6.3		Moderately toxic	40228401 F.L. Mayer 1986	Supplemental
Sheepshead Minnow *(Cyprinodon variegatus)*	96. 8		0.44/<0.44[1]	Weight and survival	42312901/Ward & Boeri /1992	Supplemental
Eastern oyster (shell deposition or embryo-larvae) *(Crassostrea virginica)*	96. 8	4. 9		Moderately toxic	42217201Ward & Boer/1991	Core
Brown shrimp *(Penaeus aztecus)*	95	>1		Moderately toxic	40228401 F.L. Mayer /1986	Supplemental
Mysid *(Americamysis bahia)*	96. 8		0.56/0.27[2]	Length, # of youngs produced	42500601 Ward & Boeri	Sheepshead Minnow *(Cyprinodon variegatus)*

[1] 0.44 mg/l is the lowest concentration tested.

[2] Reproduction effect observed at 1.9 mg/l

NON-TARGET PLANT RISK ASSESSMENT

i. Terrestrial

Terrestrial plant testing (seedling emergence and vegetative vigor) is required for herbicides that have terrestrial non-residential outdoor use patterns and that may move off the application site through volatilization (vapor pressure $\geq 1.0 \times 10^{-5}$mm Hg at 25°C) or drift (aerial or irrigation) and/or that may have endangered or threatened plant species associated with the application site.

For seedling emergence and vegetative vigor testing the following plant species and groups should be tested: (1) six species of at least four dicotyledonous families, one species of which is soybean (*Glycine max*), and the second of which is a root crop, and (2) four species of at least two monocotyledonous families, one of which is corn (*Zea mays*).

The registrant has conducted the terrestrial Tier II plant study and submitted their results. Tier II tests measure the response of plants, relative to a control, and five or more test concentrations. Results of Tier II toxicity testing on the technical material are tabulated below.

Table E 1. Nontarget terrestrial plant seedling emergence toxicity (Tier II)

Species	% ai	EC25/EC05 (lbs ai/A) EndpointAffecte	MRID No. Author/Year	Study Classification
Monocot- Corn	96.8	5.7 / 0.75 Shoot height	42398501/McKelvey & Kuratle/1992	Core
Monocot- sorghum	96.8	0.81 / 0.75 Shoot height	42398501/McKelvey & Kuratle/1992	Core
Monocot- onion	97.3	0.099 / 0.089 Shoot dry weight	44114301/Heldreth & McKelvey	Core
Monocot- wheat	97.3	1.05 / 0.38 Shoot dry weight	44113401/Heldreth & McKelvey/1996	Core
Dicot- Root Crop (pea)	96.8	>12 / 12 Shoot height	42398501/McKelvey & Kuratle/1992	Core
Dicot- Soybean	96.8	<12 / 12 Shoot height	42398501/McKelvey & Kuratle/1992	Core
Dicot-Cucmber	96.8	0.34 / 0.19 Shoot height	42398501/McKelvey & Kuratle/1992	Core
Dicot-Rape	97.3	0.094 / 0.047 Shoot dry weight	44113401/Heldreth & McKelvey/1996	Core
Dicot- Sugar beet	97.3	0.092 / 0.047 Shoot dry weight	44113401/Heldreth & McKelvey/1996	Core
Dicot- Tomato	97.3	0.08 / 0.047 Shoot dry weight	44113401/Heldreth & McKelvey/1996	Core

For Tier II seedling emergence tomato is the most sensitive dicot and onion is the most sensitive monocot. The guideline (123-1) is fulfilled/not fulfilled (MRID 44113401, 42398501).

Table E2. Nontarget Terrestrial Plant Vegetative Vigor Toxicity (Tier II)

Species	% ai	EC25/EC05 (lbs ai/A) Endpoint Affected	MRID No. Author/Year	Study Classification
Monocot- Corn	96.8	0.39 / 0.19 Shoot dry weight	42398501/McKelvey & Kuratle/1992	Core
Monocot- Onion	97.3	0.148 / 0.094 Shoot dry weigh	44113401/Heldreth & McKelvey/1996	Core
Monocot- Sorghum	97.3	0.075 / 0.012 Shoot dry weight	44113401/Heldreth & McKelvey/1996	Core
Wheat		0.021 / 0.002 Sho1ot dry weight	44113401/Heldreth & McKelvey/1996	Core
Dicot- Root Crop (Pea)	97.3	0.014 / 0.003 Shoot dry weight	44113401/Heldreth & McKelvey/1996	Core
Dicot- Soybean	96.8	0.012 / 0.002 Shoot dry weight	42398501/McKelvey & Kuratle/1992	Core
Dicot- Rape	97.3	0.033 / 0.012 Shoot dry weight	44113401/Heldreth & McKelvey/1996	Core
Dicot-Cucumber	96.8	0.005 / 0.005 Shoot dry weight	42398501/McKelvey & Kuratle/1992	Core
Dicot- Sugar beet	96.8	0.009 / 0.005 Shoot dry weight	42398501/McKelvey & Kuratle/1992	Core
Dicot-Tomato	96.8	0.002 / 0.001 Shoot dry weight	42398501/McKelvey & Kuratle/1992	Core

For Tier II vegetative vigor tomato is the most sensitive dicot and wheat is the most sensitive monocot. The guideline (123-1) is fulfilled/not fulfilled (MRID 42398501, 44113401).

II. Exposure and Risk to Nontarget Plants

i. Dry and Semi-aquatic Areas

Terrestrial plants inhabiting dry and semi-aquatic areas may be exposed to pesticides from runoff, spray drift or volatilization. Semi-aquatic areas are those low-lying wet areas that may be dry at certain times of the year. EFED's runoff scenario is: (1) based on a pesticide's water solubility and the amount of pesticide present on the soil surface and its top one inch, (2) characterized as "sheet runoff" (one treated acre to an adjacent acre) for dry areas, (3) characterized as "channelized runoff" (10 treated acres to a distant low-lying acre) for semi-aquatic areas, and (4) based on % runoff values of 0.01, 0.02, and 0.05 for water solubility of <10 ppm, 10-100 ppm, and >100 ppm, respectively.

Spray drift exposure from ground application is assumed to be 1% of the application rate. Spray drift from aerial, airblast, forced-air, and chemigation applications is assumed to be 5% of the application rate.

EECs are calculated for the following application methods: (1) unincorporated ground applications,, and (2) aerial, airblast, forced-air, and chemigation applications. Formulas for calculating EECs for dry areas adjacent to treatment sites and EECs for semi-aquatic areas are in an addendum.Estimated environmental concentrations for dry and semi-aquatic areas are tabulated below.

Table E 3. Estimated Environmental Concentrations (lbs ai/A) For Dry and Semi-Aquatic Areas for a Single Application

Site/ Application Method/ Rate of Application in lbs ai/A	Minimum Incorporation Depth (cm)	Runoff Value	Sheet Run-off (lbs ai/A)	Channelized Runoff (lbs ai/A)	Drift (lbs ai/A)	Total Loading to Adjacent Area (Sheet Run-off+Drift) 1/	Total Loading to Semi-aquatic Area (Channel Run-off+ Drift) 2/
Railroad Unincorporated Ground							
12	0	0.05	0.60	6.00	0.12	0.72	6.12
Grape Unincorporated Ground							
9.6	0	0.05	0.48	4.80	0.10	0.58	4.90
Citrus Unincorporated Ground							
6.4	0	0.05	0.32	3.20	0.06	0.38	3.26
Alfalfa/Sugarcane/Grass seeds Unincorporated Ground							
3.2	0	0.05	0.16	1.60	0.03	0.19	1.63
Cotton Unincorporated Ground							
1.6	0	0.05	0.08	0.80	0.02	0.10	0.82
Railroad/Right of way Aerial,							
12	0	0.05	0.36	3.60	0.60	0.96	4.20
Citrus Airblast							
9.6	0	0.05	0.29	2.90	0.48	0.77	3.38
Alfalfa/Sugarccane Aerial,							
3.2		0.05	0.10	1.00	0.16	0.26	1.16
Cotton Aerial							
1.6	0	0.05	0.05	0.50	0.08	0.13	0.58

1/ Dry area EEC / Seeding Emergence EC25, 2/ Semi-aquatic EEC / Seeding Emergence EC25

The EC25 value of the most sensitive species in the seedling emergence study is compared to runoff and drift exposure to determine the risk quotient (EEC/toxicity value). The EC25 value of the most sensitive species in the vegetative vigor study is compared to the drift exposure to determine the acute risk quotient.

The NOEC or EC05 (if NOEC is unavailable) value of the most sensitive species in the seedling emergence study is compared to runoff and drift exposure to determine the endangered species risk quotient. The NOEC or EC05 value of the most sensitive species in the vegetative vigor study is compared to the drift exposure to determine the endangered species risk quotient.

EECs and acute (endangered species) risk quotients for terrestrial plants based on a single application are tabulated below. Risk quotients based on seedling emergence on NOEC or EC05 ranged from 5 to 48 for dry area and from 29 to 306 for semi aquatic areas. RQ values were 20 and 100 for ground application and aerial application, respectively (Table 9).

Thus a single application, plant acute high risk and endangered species levels of concern are exceeded for terrestrial plants in dry areas and semi-aquatic area at a registered maximum single application rate equal to or above 1.6 lb/A. The results also implicate that for multiple applications, plant acute high risk and endangered species levels of concerns will exceeded for terrestrial plants in both dry and semiaquatic areas at a registered minimum label rate. Currently, EFED does not perform chronic risk assessments for terrestrial plants

ii. Aquatic Plants

Aquatic plant testing is required for diuron that has outdoor non-residential terrestrial uses that may move off-site by runoff (solubility >10 ppm in water), by drift (aerial), or that is applied directly to aquatic use sites (except residential). The registrant has chose to conduct Aquatic Tier II studies. For Aquatic Tier II studies, the following species should be tested at Tier II: *Pseudokirchneria subcapitata*, *Lemna gibba*, *Skeletonema costatum*, *Anabaena flos-aquae*, and freshwater diatom.

Results of Tier II toxicity testing on the technical material are tabulated below.

Table E 4. Nontarget Aquatic Plant Toxicity (Tier II)

Species	% ai	EC50/ (ppb)	MRID No. Author/Year	Study Classification
Vascular Plants				
Duckweed *Lemna gibba*	-	-	-	-
-Nonvascular Plants				
Green algae *Selenastrum capricornutum*	96.8	2.4	42218401/Blasberg & Hicks/1991	Core
Green algae *Dunaliella tertiolecta*	95	20	40228401/Mayer, F.L./1986	Supplemental
Green algae *Chlamydomonas sp.*	95	37	40228401/Mayer, F.L./1986	Supplemental
Green algae *Chlorococcum sp.*	95	10	40228401/Mayer, F.L./1986	Supplemental
Green algae *Chlorella sp.*	95	19	40228401/Mayer, F.L./1986	Supplemental
Green algae *Neochloris sp.*	95	28	40228401/Mayer, F.L./1986	Supplemental

Table E 4. Nontarget Aquatic Plant Toxicity (Tier II)

Species	% ai	EC50/ (ppb)	MRID No. Author/Year	Study Classification
Marine diatom *Skeletonema costatum*	–	–	–	–
Marine diatom *Phaeodactylum tricornutum*	95	10	40228401/Mayer, F.L./1986	Supplemental
Freshwater diatom *Navicula pelliculosa*	–	–	–	–
Freshwater diatom *Thallssiosira fluviatilus*	95	95	40228401/Mayer, F.L./1986	Supplemental
Blue-green algae *Anabaena flos-aquae*	–	–	–	–
Algae *Monochrysis lutheri*	95	18	40228401/Mayer, F.L./1986	Supplemental
Algae *Isochrysis galbana*	95	10	40228401/Mayer, F.L./1986	Supplemental
Algae Cyclotella nana	–	–	–	–
Algae *Achnanthes brevipes*	95	24	40228401/Mayer, F.L./1986	Supplemental
Algae *Navicula incerta*	95	93	40228401/Mayer, F.L./1986	Supplemental
Algae *Stauroneis amphoroides*	95	31	40228401/Mayer, F.L./1986	Supplemental
Algae *Amphora exigua*	95	31	40228401/Mayer, F.L./1986	Supplemental
Algae *Nitzschia closterium* sp	95	50	40228401/Mayer, F.L./1986	Supplemental

The Tier II results indicate that only the study with Green algae *Selenastrum capricornutum* toxicity study is acceptable. All other studies submitted is not acceptable because the plant species not recommended species (Table E4).

ii. Aquatic Plants

Exposure to nontarget aquatic plants may occur through runoff or spray drift from adjacent treated sites or directly from such uses as aquatic weed or mosquito larvae control. An aquatic plant risk assessment for acute high risk is usually made for aquatic vascular plants from the surrogate duckweed *Lemna gibba*. Non-vascular acute high aquatic plant risk assessments are performed using either algae or a diatom, whichever is the most sensitive species. An aquatic plant risk assessment for acute- endangered species is usually made for aquatic vascular plants from the surrogate duckweed *Lemna gibba*. To date there are no known non-vascular plant species on the endangered species list. Runoff and drift exposure is computed from either GENEEC or PRIZM3/EXAMS 2.95 **(GENEEC II used)**. The risk quotient is determined by dividing the pesticide's initial or peak concentration in water by the plant EC50 value.

Based on an EC50 value for green algae (EC50 = 0.0021 ppm) and EEC value ranged from 0.022 mg/l to 0.412 ppm, acute risk quotients for non-vascular plants are from 9.58 to 171.67. Based on these RQ values, the results indicate that plant acute high risk and endangered species levels of concern are exceeded for nonvascular plants at registered minimum label rate of 1.6 lbs. ai/A.(Table 10). However, acute RQ for vascular aquatic plant and endanger species ane not calculated because lack of duckweed (*Lemna gibba*) toxicity data. Currently, EFED does not perform assessments for chronic risk to aquatic plants.

Appendix 4

Environmental Fate and Transport Studies Reviewed

(1) MRID No. 41418804 (161-1)
Hawkins, D.R. et al. 1988. The hydrolytic stability of ^{14}C-diuron, 21 April 1988. Huntingdon Research Center, Report No. HRC/DPT 177/88698. EFGWB 90-0737.

(2) MRID No. 41418805 (161-2)
Hawkins, D.R. et al. 1988. The photodegradation of ^{14}C-diuron in water, 30 August 1988. Huntingdon Research Center, Report No. HRC/DPT 177/881179. EFGWB 90-0737.

(3) MRID No. 41719302 (161-3)
Stevenson, I.E. 1990b. Photodegradation of [phenyl(U)-^{14}C]diuron on soil under artificial sunlight. Laboratory Project ID: AMR-771-87. Unpublished study performed by Biospherics, Inc., Rockville, MD, and Cambridge Analytical Associates, Boston, MA, and submitted by E.I. du Pont de Nemours and Company, Wilmington, DE.

(4) MRID No. 4179303 (162-1)
Hawkins, D.R., D. Kirkpatrick, D. Shaw, and S.C. Chan. 1990. The metabolism of [phenyl(U)-^{14}C]diuron in Keyport silt loam soil under aerobic conditions. Du Pont Report No. AMR-1202-88. Huntingdon Research Center Report No. HRC/DPT 189/891860. Unpublished study performed by Huntingdon Research Centre, Huntingdon, Cambridgeshire, England, and submitted by E.I du Pont de Nemours & Company, Inc., Wilmington, DE.

(5) MRID No. 41418806 (162-2)
Yu, W.C. 1988. Anaerobic soil metabolism of [phenyl(U)-14C]diuron, 30 August 1988. Cambridge Analytical Associates.

(6) MRID No. 44221001 (162-3)
Hausmann, S.M. 1992. Anaerobic aquatic metabolism of [phenyl(U)-^{14}C]diuron. Laboratory Project ID: AMR 2067-91. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Wilmington, DE.

(7) MRID No: 44221002 (162-4)
Hausmann, S.M., and G.M. Kraut. 1992. Aerobic aquatic metabolism of [phenyl(U)-^{14}C]diuron. Laboratory Project ID: AMR 2066-91. Unpublished study performed and submitted by E. I. du Pont de Nemours and Company, Wilmington, DE.

(8) MRID No. 444490501 (163-1)
Bramble, F. Q., F. D. Behmke, and G. I. Norwood. 1998. Batch equilibrium (adsorption/desorption) of ^{14}C-diuron, fenuron, and N'-(3-chlorophenyl)-N,N-dimethylurea on soil. DuPont Project ID: AMR 4584-97. Unpublished study performed and submitted by E. I. du

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Pont de Nemours and Company, Wilmington, DE.

(9) MRID No. 444865001 (164-1)
Bramble, F.Q. Jr., F. D. Behmke, R.S. Frizzel., and G.I. Norwwod. July 2, 1998. Field soil dissipation of diuron following application of Karmex DF herbicide. Performed by E.I. du pont de Nemorous and Company, Wilmington, DE 19880-0402. Sponsored by E.I. du pont de Nemorous and Company, Wilmington, DE 19898. Report No. AMR 4383-97.

(10) MRID No. 44865001 (164-1)
Tweedy, B.G. June 28, 1999. Field soil dissipation of diuron following application of Karmex DF herbicide. Performed by ABC Laboratories, Columbia, MO. Sponsored by Griffin LLC, P.O. Box 1847, Valdosta, GA 31603-1847. Project Identification No.GP98-084 (7B) MRID No: 44386701